

AIR FORCE QUALIFICATION TRAINING PACKAGE (AFQTP)



for
HVAC/REFRIGERATION
(3E1X1)

MODULE 27
AFSC SPECIFIC CONTINGENCY RESPONSIBILITIES

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MODULE 27

AFSC SPECIFIC CONTINGENCY RESPONSIBILITIES

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|-------------------------|-------|

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|--|
| Career Field Education and Training Plan (CFETP) references from 1 Apr 97 version. |
|--|

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Notice. This AFQTP is NOT intended to replace the applicable technical references nor is it intended to replace hands-on training. It is to be used in conjunction with these for training purposes only.

AIR FORCE QUALIFICATION TRAINING PACKAGES
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INTRODUCTION

Before starting this AFQTP, refer to and read the “Trainee/Trainer Guide” located on the AFCESA Web site <http://www.afcesa.af.mil/>

AFQTPs are mandatory and must be completed to fulfill task knowledge requirements on core and diamond tasks for upgrade training. *It is important for the trainer and trainee to understand* that an AFQTP **does not** replace hands-on training, nor will completion of an AFQTP meet the requirement for core task certification. AFQTPs will be used in conjunction with applicable technical references and hands-on training.

AFQTPs and Certification and Testing (CerTest) must be used as minimum upgrade requirements for Diamond tasks.

MANDATORY minimum upgrade requirements:

Core task:

AFQTP completion
Hands-on certification

Diamond task:

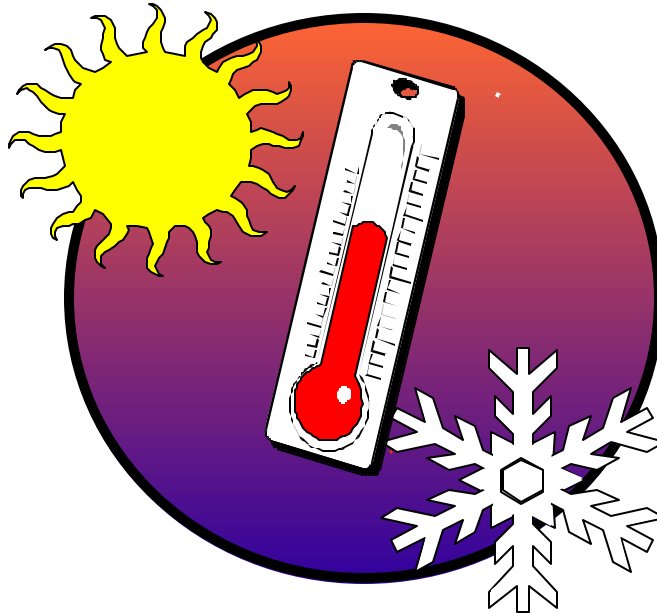
AFQTP completion
CerTest completion (80% minimum to pass)

Note: *Trainees will receive hands-on certification training for Diamond Tasks when equipment becomes available either at home station or at a TDY location.*

Put this package to use. Subject matter experts, under the direction and guidance of HQ AFCESA/CEOT, revised this AFQTP. If you have any recommendations for improving this document, please contact the HVAC/R Career Field Manager at the address below.

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IMMERSION HEATER

MODULE 27

AFQTP UNIT 2

PERFORM OPERATIONAL TESTS

(27.2.1.2.2.)

Notice. This AFQTP is NOT intended to replace the applicable technical references nor is it intended to replace hands-on training. It is to be used in conjunction with these for training purposes only.

PERFORM OPERATIONAL TESTS

Task Training Guide

| | |
|---|--|
| STS Reference Number/Title: | 27.2.1.2.2. Perform Operational Tests |
| Training References: | <ul style="list-style-type: none">• CD-ROM Immersion Heater QTP 3E1X1-27.2.1.2.2 Version 1• TM 5-4540-202-12&P• TM 10-4500-200-13• AFPAM 10-219, Vol. 5 |
| Prerequisites: | <ul style="list-style-type: none">• Possess as a minimum a, 3E131 AFSC. |
| Equipment/Tools Required: | <ul style="list-style-type: none">• Leather Gloves/ PPE• Corrugated Can• Standard Tool Bag |
| Learning Objective: | <ul style="list-style-type: none">• Trainee should know the steps to perform operational checks on immersion heaters. |
| Samples of Behavior: | <ul style="list-style-type: none">• Trainee should be able to perform operational checks on immersion heaters.• Trainee should be able to safely shut down the immersion heater after operational test. |
| Notes: | |
| <ul style="list-style-type: none">• Any safety violation is an automatic failure. | |

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PERFORM OPERATIONAL TESTS

Background: Usually when personnel are required to perform their duties under field conditions they will be issued a personal field mess kit. If personal mess kits are not maintained in as sanitary a condition as possible the member could possibly become a victim of an intestinal disorder. Immersion heaters will take the place of dishwashers in field conditions. They will be used to clean and sanitize your personal mess kits and food preparation equipment.

Services or Prime RIBS personnel will set up and operate personal mess kit cleaning areas, using the immersion heater as the source of heat for cleaning and sanitizing solutions. The personal mess kit cleaning area will include immersion heaters for sanitation prior to food consumption, and an area to clean the mess kit after food consumption. The cleaning area may include several immersion heaters for many different purposes. One may be used for pre-rinsing prior to the actual cleaning while the others may be used for the actual cleaning and final rinsing.

Under normal circumstances it will be the responsibility of the Services or Prime RIBS personnel to set up and operate the immersion heaters. As a potential Prime BEEF member you must know how to set up and operate the immersion heaters because you will be expected to make repairs when necessary. It should go without saying that you must know how something works before you can fix it. There is also a secondary reason why we as Prime BEEF team members must know how to operate immersion heaters. As part of our Civil Engineering mission we may be called upon to be part of a pre-deployment team. Pre-deployment teams usually arrive in advance of other personnel such as Services or Prime RIBS who provide meals. In this instance we will have to set up and operate the immersion heaters ourselves.

To perform this task, view AFQTP Immersion Heater 3E1X1-27.2.1.2.2 Version 1 CD-ROM

NOTE:

In the CD-ROM there are tests after each section. Complete each section and answer the questions.

SAFETY:

USE THE HEATER ONLY IN A WELL-VENTILATED AREA. IF THE HEATER IS USED INSIDE A BUILDING OR TENT, BE SURE THE EXHAUST FUMES ARE PIPED OUTSIDE. THE FUMES ARE POISONOUS AND CAN CAUSE ILLNESS OR DEATH IF INHALED.

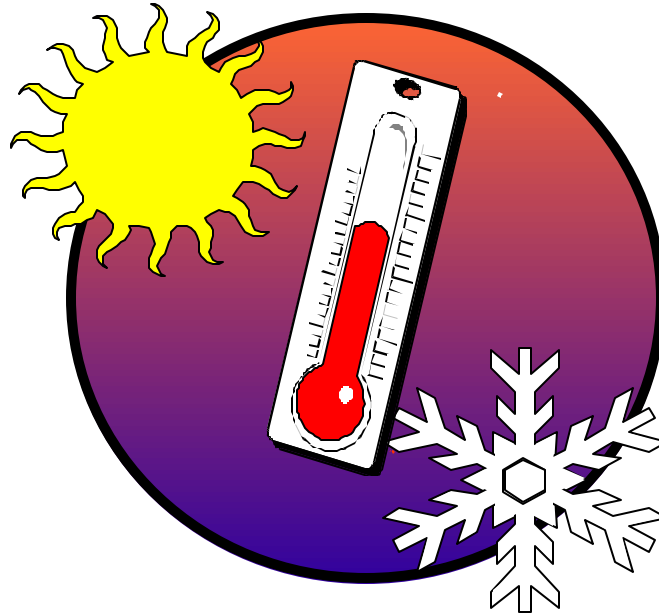
Notice. This AFQTP is NOT intended to replace the applicable technical references nor is it intended to replace hands-on training. It is to be used in conjunction with these for training purposes only.

PERFORM OPERATIONAL TESTS

| Performance Checklist | | |
|-------------------------------------|-----|----|
| Step | Yes | No |
| 1. Demonstrate Setup Procedures | | |
| a. Location | | |
| b. Inspect and setup | | |
| c. Service | | |
| 2. Demonstrate Starting Procedures | | |
| a. Preheating | | |
| b. Lighting torch model | | |
| c. Igniting | | |
| d. Final adjustments | | |
| 3. Demonstrate Shut Down Procedures | | |
| a. Fuel control valve | | |
| b. Fuel vent cap/plug | | |
| c. Fuel tank | | |
| d. Smoke pipe | | |
| e. Excess fuel | | |

FEEDBACK: Trainer should provide both positive and/or negative feedback to the trainee immediately after the task is performed. This will ensure the issue is still fresh in the mind of both the trainee and trainer.

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TENT HEATERS PREWAY & M 1941, TYPES I & II

MODULE 27

AFQTP UNIT 2

SETUP

(27.2.1.3.2.)

Notice. This AFQTP is NOT intended to replace the applicable technical references nor is it intended to replace hands-on training. It is to be used in conjunction with these for training purposes only.

SETUP***Task Training Guide***

| | |
|---|---|
| STS Reference Number/Title: | 27.2.1.3.2. Setup |
| Training References: | <ul style="list-style-type: none"> • TM 10-4500-200-13 • TM 5-4520-235-13 • CDC 3E151B Volume 4 Specific Contingency • Study Guide Workbook, J3ABR3E131 003-VII-1-4 • CD-ROM Preway Space Heater QTP 3E1X1-27.2.1.3.2 3E1X1-27.2.1.3.3 |
| Prerequisites: | <ul style="list-style-type: none"> • Possess as a minimum a, 3E131 AFSC |
| Equipment/Tools Required: | <ul style="list-style-type: none"> • Type I: leather gloves, standard screwdriver set, 6” pliers. • Type II: leather gloves, standard screwdriver set, torpedo level, 10” pipe wrench, 8” adjustable wrench (2 ea), 6” pliers. • Preway: leather gloves, standard screwdriver set, 8” adjustable wrench (2 ea.), 6” pliers, torpedo level. |
| Learning Objective: | <ul style="list-style-type: none"> • The trainee should know the steps required to safely perform the setup of a Model 1941 Type I & Type II, and Preway Tent Heaters. |
| Samples of Behavior: | <ul style="list-style-type: none"> • Trainee should be able to safely perform setup of a Model 1941 Type I & II, and Preway Tent Heaters. • Trainee should be able to identify the specific components of the Model 1941 Type I & II, and Preway Tent Heaters. |
| Notes: | |
| <ul style="list-style-type: none"> • To successfully complete this element, the steps must be followed exactly. • Any safety violation is an automatic failure. | |

Notice. This AFQTP is NOT intended to replace the applicable technical references nor is it intended to replace hands-on training. It is to be used in conjunction with these for training purposes only.

SETUP

Background: The Type I heater can produce heat using a variety of non-toxic solid type fuels. As an example wood, coal, charcoal, etc. can be used in the Type I heater. The heater assembly consists of a heater top, heater bottom, adapter ring, grate assembly, and smoke pipe sections. Accessories such as the spark arrestor, tent shield and an elbow are not stocked with a complete space heater and must be ordered separately if needed. (Figure 1)

To perform this task, follow these steps:

Step 1: Equipment Inspection.

- Inspect the entire heater assembly for signs of physical damage, security, cleanliness, and mechanically operable.
- Inspect the pipe sections to ensure there are no holes or unserviceable sections.
- Inspect the flue damper for proper operation.
- Make sure all accessories are available if needed.

Step 2: Assembly.

- Always place heater base in sandbox if using it on a combustible surface.
- Place the adapter ring on the bottom piece. Level the heater by sight.
- Install the grate assembly in the adapter ring. Ensure the shaker/catch assembly handle is facing out towards the ash pit door.
- Place the top on the heater on unit.
- Ensure that the flue damper is installed above the first section of smoke pipe.
- Assemble and install the remaining sections of smoke pipe. Ensure enough pipe is installed so that at least one full section of pipe is visible above the tent.
- Install the spark arrestor one pipe section above the heater pipe out-side of the shelter. Refer to T.M. 10-4500-200-13, change 14, page 2.7.
- Secure spark arrestor using guy wires to keep it in place.
- The Model 1941 Type I Tent Heater is now ready for use.

Notice. This AFQTP is NOT intended to replace the applicable technical references nor is it intended to replace hands-on training. It is to be used in conjunction with these for training purposes only.

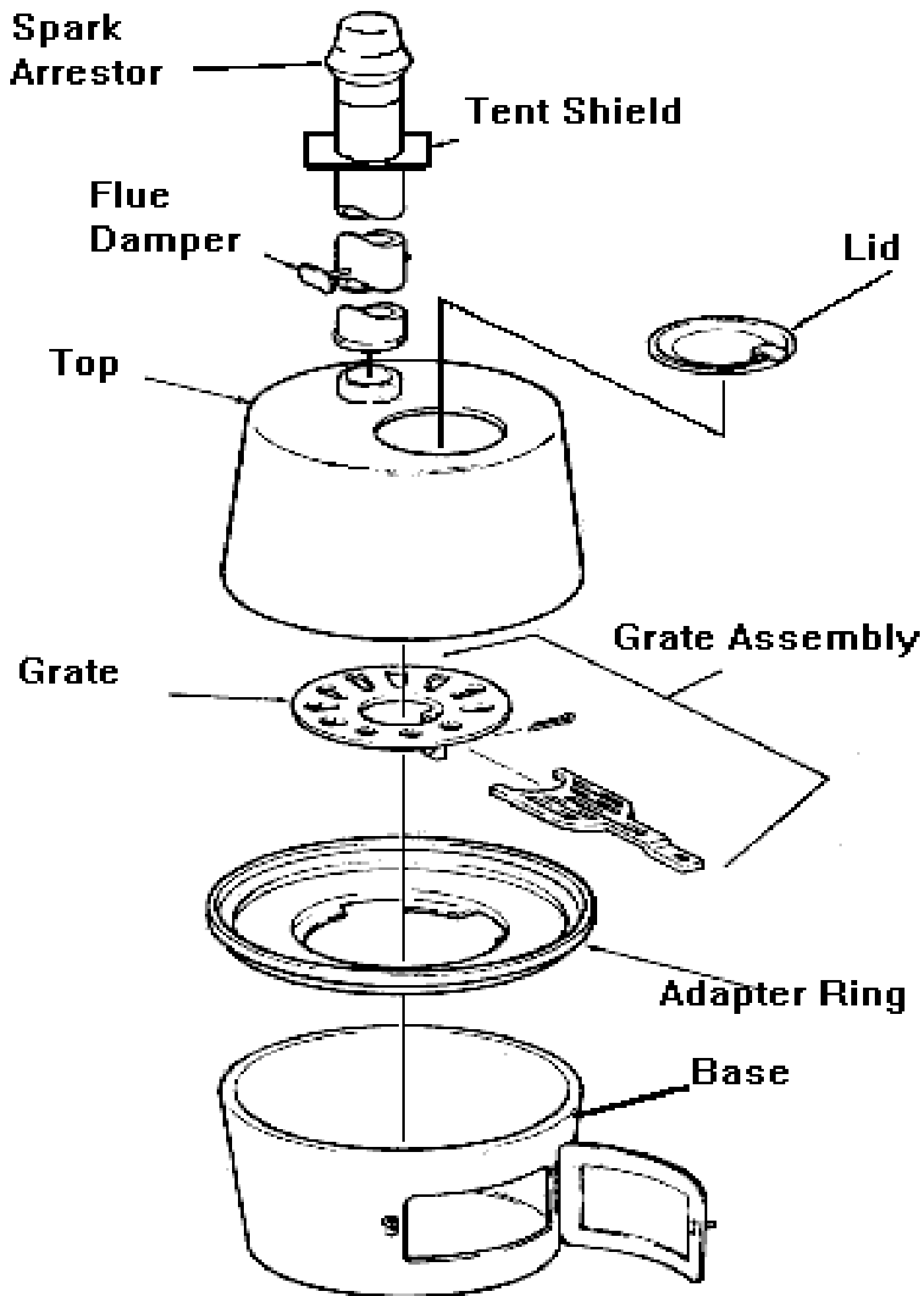


Figure 1, Tent Heater, Model 1941 Type I

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The Type II heater. The Type II heater can produce heat using a variety of liquid fuels, such as gasoline, light fuel oil, and diesel oil. The heater assembly consists of a heater top, heater bottom, adapter ring, oil pot burner, float valve, and smoke pipe sections. Accessories such as the spark arrestor, tent shield and elbow are not stocked with a complete space heater and must be ordered separately, if needed (Figure 2).

To perform this task, follow these steps:

Step 1: Equipment Inspection.

- Inspect the entire heater assembly and oil burner assembly for signs of physical damage, security, cleanliness, and mechanical operability.
- Inspect the fuel adapter assembly for damage and defective gasket.
- Inspect the overflow hose and fuel hose for deterioration, cuts, leaks, and restrictions.
- Inspect the pipe sections to ensure there are no holes or unserviceable sections.
- Inspect the flue damper for proper operation.
- Make sure all accessories are available if needed.

SAFETY:

IN TENTS WITH NON-FLAMMABLE SURFACES THE HEATER BASE MAY BE SET ON THE GROUND OR FLOOR OF THE TENT. IN TENTS WITH FLAMMABLE SURFACES, THE BASE SHOULD BE SET IN A SANDBOX OR OTHER NON-FLAMMABLE, INSULATING TYPE MATERIAL TO PROTECT THE FLOOR FROM HEAT. IN EMERGENCIES, STONES OR SIMILAR NON-HEAT TRANSFERRING MATERIALS MAY BE USED. ENSURE AREAS SURROUNDING THE HEATER WILL BE VOID OF COMBUSTIBLES AT ANY POINT CLOSER THAN A DISTANCE OF THREE FEET. EPA REQUIRES A SANDBOX OR METAL PAN TO CATCH ANY FUEL SPILLS.

Step 2: Assembly.

- Place the heater bottom on the floor or inside the sandbox if using it on a combustible surface.
- Place the ring on the bottom piece.
- Set the oil pot burner in the adapter ring so that the fuel inlet pipe faces the ash pit door.

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- Turn the adapter ring to the right until it engages the locking clips on the burner. The fuel inlet pipe should be at the right side of the door opening. Install the flame spreader in the center of the burner.
- Attach the float valve nipple to the smaller end of the pipe reducer located on the burner pot. Make sure the connection is tight enough to hold the valve in a level position and to prevent leaks.
- Place the top of the space heater on the adapter ring.
- Assemble and install the smoke pipe. Install the spark arrestor on top of the stack and anchor it with guy wires.

Fuel System:

- Assemble the fuel can adapter, and insert it in the fuel can. Attach the male end of one fuel hose to the drip loop hose of the adapter, and attach the opposite female end of the hose to the male fuel inlet fitting of the float valve.
- Attach the other length of hose to the overflow fitting (female fitting of the float valve) to carry off any possible overflow. This hose must drain downward and discharge into a safe outside location.
- Make sure that the inlet shutoff knob on the float valve is in the OFF position.
- Invert the fuel can to initiate gravity feed of the fuel into the burner. Ensure that the can is on a support no less than 2 feet or more than 8 feet above the float valve.
- The Model 1941 Type II Tent Heater is now ready for use.

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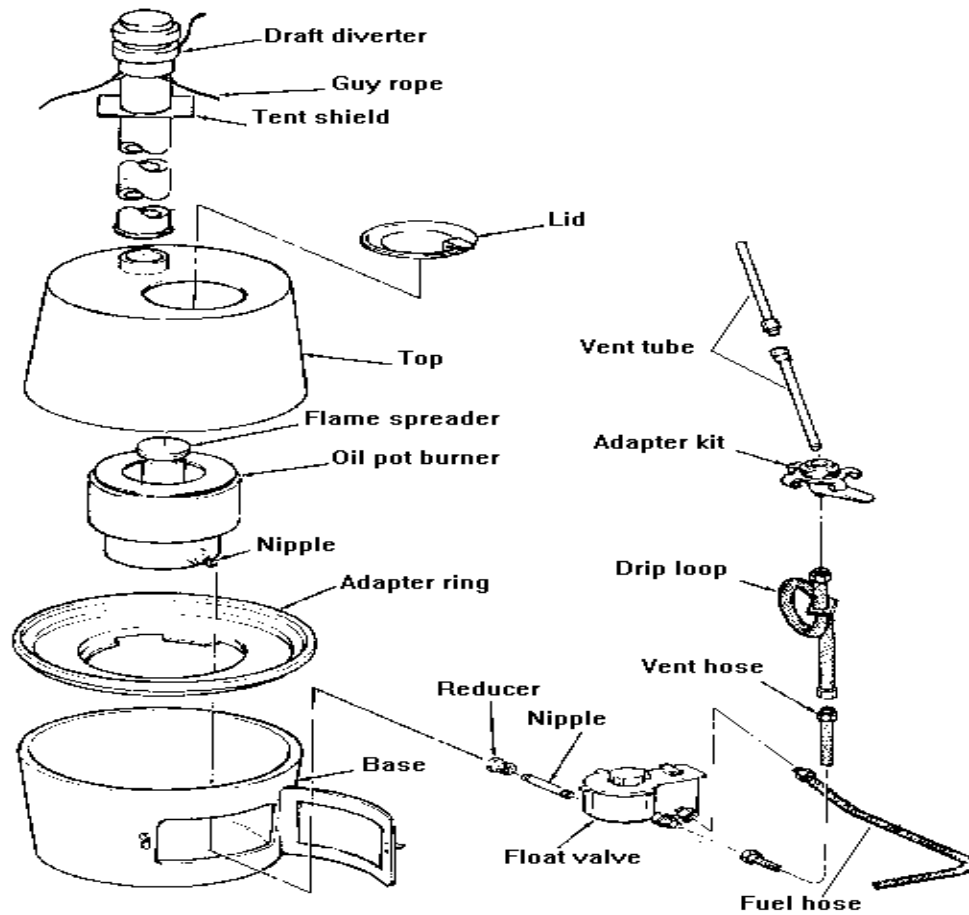


Figure 2, Tent Heater, Model 1941 Type II

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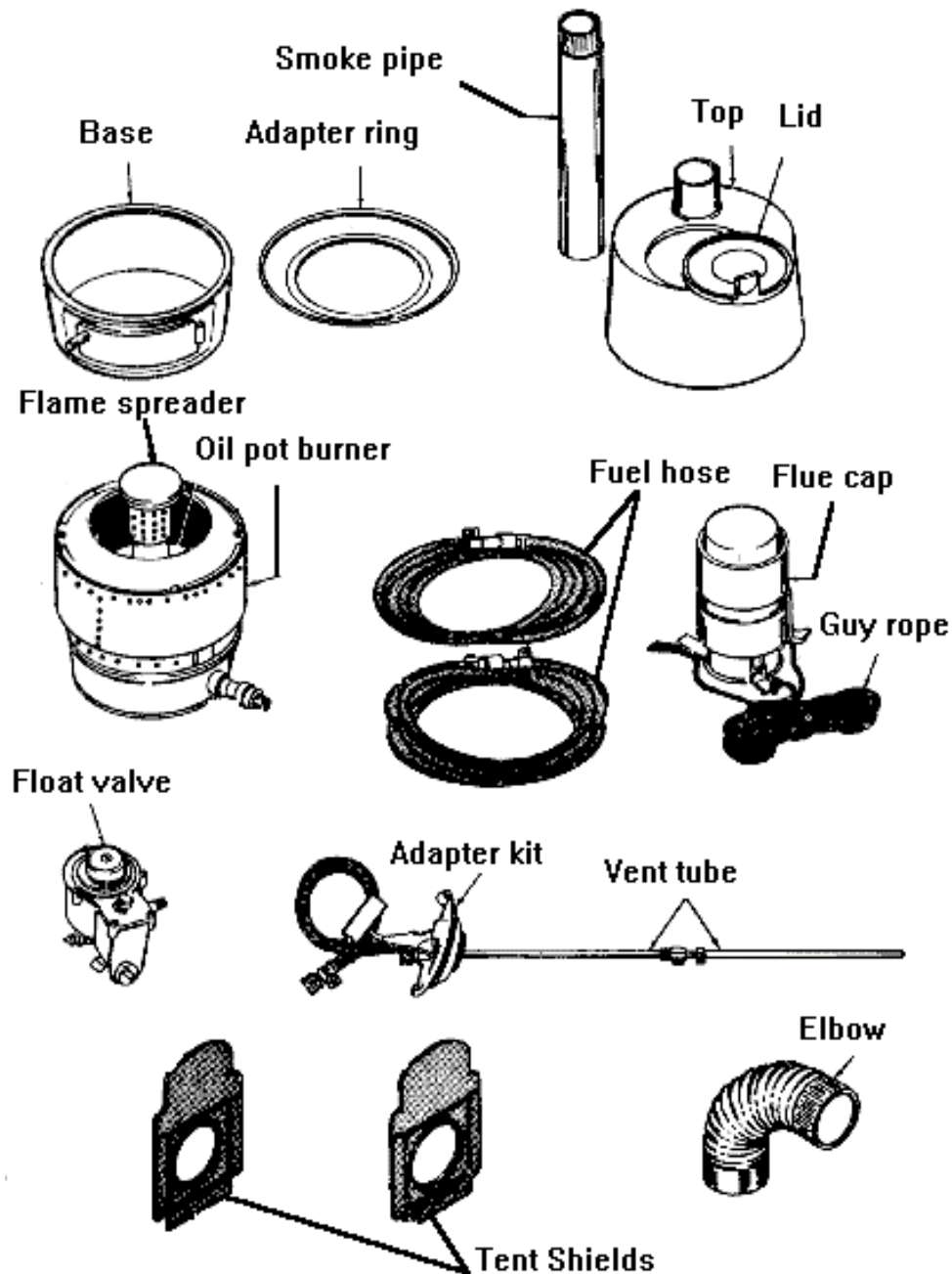


Figure 3, Tent Heater, Model 1941 Type II Accessories

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The Preway Tent Heater. The Preway Tent Heater is a fuel oil burning, non-electric, high radiant type heater having an output of 70,000 BTUs. Use only diesel fuel or an equivalent! These space heater units are supplied complete with stovepipe, T-joint, draft regulator, and are designed for floor installations.

To perform this task, view AFQTP 3E1X1-27.2.1.3.2 3E1X1-27.2.1.3.3 Version 1.0 Preway Space Heater CD-ROM.

NOTE:

In the CD-ROM there are tests after each section. Complete each section and answer the questions.

SAFETY:

EPA REQUIRES SOMETHING TO CATCH FUEL SPILLS. IN TENTS WITH FLAMMABLE SURFACES, THE BASE SHOULD BE SET IN A SANDBOX OR OTHER NON-FLAMMABLE, INSULATING TYPE MATERIAL TO PROTECT THE FLOOR FROM HEAT. IN EMERGENCIES, STONES OR SIMILAR NON-HEAT TRANSFERRING MATERIALS MAY BE USED. ENSURE AREAS SURROUNDING THE HEATER WILL BE VOID OF COMBUSTIBLES AT ANY POINT CLOSER THAN A DISTANCE OF THREE FEET

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**Review Questions
for
Setup of Type I**

| Question | Answer |
|--|--|
| 1. If you are setting up a tent heater in a tent that has wooden floors, what must be done before you place the heater on the floor? | a. Place heater base in sandbox b. Place fire extinguisher close c. Have a box of salt handy d. Have a bucket of water on floor |
| 2. What is the purpose of the heater base on an assembled stove? | a. As an ash pit which provides a draft for the fire and enables the adjustment of heat output by regulating the amount of air entering the unit. b. Help remove ashes c. Regulate air flow d. Regulate heat flow |
| 3. What part of the tent heater is used as a support for the fuel bed? | a. Grate b. Adapter ring c. Heater top d. Heater base |
| 4. What is the purpose of the spark arrestor? | a. To prevent sparks from the fire to be drawn out of the tent heater and possibly starting a fire. b. Eliminates the necessity of climbing on top of the tent to clean the arrestor and allows the stack sections to be disjointed from inside the tent. |
| 5. State the purpose of the heater top. | Written Answer |

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**Review Questions
for
Setup of Type II**

| Question | Answer |
|--|--|
| 1. What components are located in the heater base? | a. Steel pot with an adapter ring, oil-pot burner. b. Cast-iron flame spreader. c. Fuel inlet nipple with reducer. d. All the above |
| 2. Where is the flame spreader installed? | a. Heater base b. Float valve c. Fuel line d. Can adapter |
| 3. What is the minimum height the fuel can should be installed above the float valve? | a. 1 foot b. 2 feet c. 4 feet d. 8 feet |
| 4. What is used to provide a means of coupling the fuel hose to the fuel supply on a 5-gallon can? | a. Gravity feed adapter with drip interceptor. b. Valve feeder c. Rubber washer on can |
| 5. The drip interceptor consists of a short rubber hose held in a loop by a metal plate. | a. True b. False |

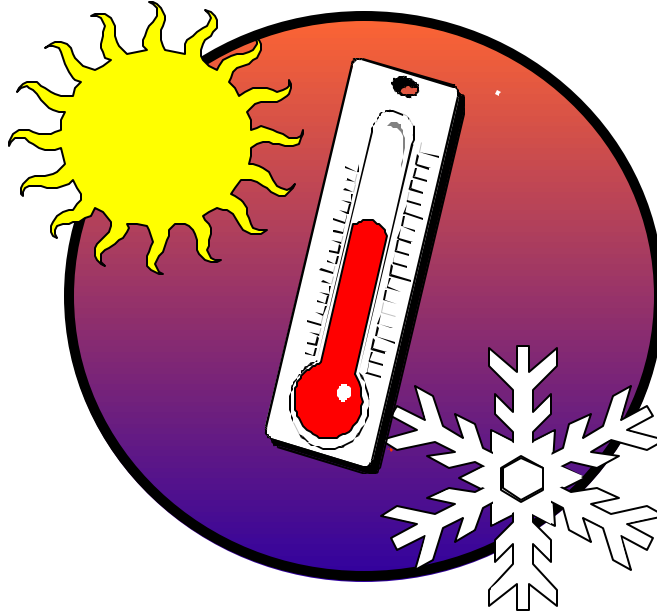
Notice. This AFQTP is NOT intended to replace the applicable technical references nor is it intended to replace hands-on training. It is to be used in conjunction with these for training purposes only.

SET-UP

| Performance Checklist | | |
|---|------------|-----------|
| Step | Yes | No |
| 1. Did the trainee properly set-up a tent heater? | | |
| 2. Did the trainee correctly identify components of the Type I heater? | | |
| 3. Did the trainee correctly identify components of the Type II heater? | | |
| 4. Does the trainee set up the Preway heater properly? | | |

FEEDBACK: Trainer should provide both positive and/or negative feedback to the trainee immediately after the task is performed. This will ensure the issue is still fresh in the mind of both the trainee and trainer.

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TENT HEATERS PREWAY & M 1941, TYPES I & II

MODULE 27

AFQTP UNIT 2

PERFORM OPERATIONAL TESTS

(27.2.1.3.3.)

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PERFORM OPERATIONAL TESTS

Task Training Guide

| | |
|---|--|
| STS Reference Number/Title: | 27.2.1.3.3. Perform Operational Tests |
| Training References: | <ul style="list-style-type: none"> • TM 10-4500-200-13 • TM 5-4520-235-13 • CDC 3E151B Volume 4 Specific Contingency • Study Guide Workbook, J3ABR3E131 003-VII-1-4 • CD-ROM Preway Space Heater QTP 3E1X1-27.2.1.3.2 3E1X1-27.2.1.3.3 |
| Prerequisites: | <ul style="list-style-type: none"> • Possess as a minimum a, 3E131 AFSC. |
| Equipment/Tools Required: | <ul style="list-style-type: none"> • Type I: leather gloves, fire extinguisher, shovel, poker, stoker, and ignition source • Type II: leather gloves, fire extinguisher, adjustable wrench 8", and ignition source • Preway: leather gloves, fire extinguisher, adjustable wrench 8" (2 ea.), and ignition source |
| Learning Objective: | <ul style="list-style-type: none"> • The trainee should know the steps required to safely perform an operational test of a Model 1941, Type I & II, and Preway Tent Heaters. |
| Samples of Behavior: | <ul style="list-style-type: none"> • Trainee should be able to safely perform an operational test of a Model 1941, Type I & II, and Preway Tent Heaters. • Trainee should be able to identify the proper operating sequence of the Model 1941 Type I & II, and Preway Tent Heaters. |
| Notes: | |
| <ul style="list-style-type: none"> • To successfully complete this element, the steps must be followed closely. • Any safety violation is an automatic failure. | |

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PERFORM OPERATIONAL TESTS

Background: The Type I heater can produce heat using a variety of non-toxic solid type fuels. As an example wood, coal, charcoal, etc. can be used in the Type I heater. Inspect the heater to see that it has been set up as directed. Make sure the grate is level and operates smoothly. See that all the smokestack sections are tight and that the damper operates freely. Make sure that the tent shields have been installed properly. Make sure the shovel, shaker, and poker are nearby. Wipe off any preservative oil from the body of the heater.

To perform this task, follow these steps:

Step 1: Starting.

- Set the flue damper in its open position.
- Open the ash pit door and remove the heater lid.
- Lay paper on the grate and crisscross kindling on top of the paper.
- Replace the heater lid.
- Ignite the paper.
- When the kindling catches fire, put one shovel of coal on the kindling.

SAFETY:

ALWAYS KEEP SAFETY PROCEDURES IN MIND WHEN DEALING WITH FIRE OR FIRE PRODUCING EQUIPMENT.

Step 2: Flame Regulating.

- Once the coal is burning well, close the ash pit door halfway. Regulate heat output by varying the ash pit door opening, and by turning the damper in the smoke pipe.
- Add coal at intervals to maintain a fire bed of about three inches on the grate. Add a shovel of coal after each previous shovel of coal begins to burn, until the desired firebed is reached. Never cover up all of the brightly burning coal with fresh coals.
- To remove ashes and clinkers, push the draw gate gently back and forth with the shaker until a faint red glow appears. Use the shaker sparingly.

Notice. This AFQTP is NOT intended to replace the applicable technical references nor is it intended to replace hands-on training. It is to be used in conjunction with these for training purposes only.

Step 3: Shutdown.

- Shake burning coals into the ash pit.
- Remove burning coals, open the ash pit door, and allow the remaining fire to burn out.

The Type II heater

- The Type II heater uses liquid fuels to produce heat. They are; light fuel oil, diesel fuel, and a 4:1 mixture of diesel and gasoline. Inspect the heater to see that it has been set up as directed. See that all the smokestack sections are tight and that the damper operates freely. Make sure that the tent shields have been installed properly. Wipe off any preservative oil from the body of the heater.

To perform this task, follow these steps:

Step 1: Starting.

- Remove the heater lid.
- When using diesel fuel, oil, or the 4:1 mixture, turn the ON-OFF valve knob of the float valve to the ON position and turn adjustment knob up to 9. When the burner bottom is wet with fuel, turn the flow adjustment knob back to 1 and drop a small wad of lighted paper or oily rag into the burner.

SAFETY:

ALWAYS KEEP SAFETY PROCEDURES IN MIND WHEN DEALING WITH FIRE OR FIRE PRODUCING EQUIPMENT. KEEP YOUR FACE AND HANDS AWAY FROM THE OPENING!

Step 2: Fuel Adjustments and Limitations.

- When the bottom is blazing, replace the top lid. Wait 15 minutes before setting the adjustment knob for the desired flame size. This is to allow warm up time for the heater.
- Maintain a clean, smokeless flame. The adjustment ranges from 1 to 9 as indicated by the arrow on the dial.

Notice. This AFQTP is NOT intended to replace the applicable technical references nor is it intended to replace hands-on training. It is to be used in conjunction with these for training purposes only.

Step 3: Shutdown.

- Invert the fuel can and place it on the ground.
- Turn the flow adjustment knob to 1, and then turn the ON-OFF valve to OFF. Allow any remaining fuel to burn out.
- Never attempt to light a heater while it is still warm. If the flame is accidentally extinguished, turn the ON-OFF valve to OFF immediately. Allow the burner to cool, then wipe excess fuel from the burner bottom before re-lighting.

The Preway Tent Heater.

To perform this task, view AFQTP 3E1X1-27.2.1.3.2 3E1X1-27.2.1.3.3 Version 1.0 Preway Space Heater CD-ROM.

NOTE:

In the CD-ROM there are tests after each section. Complete each section and answer the questions.

SAFETY:

ALWAYS KEEP SAFETY PROCEDURES IN MIND WHEN DEALING WITH FIRE OR FIRE PRODUCING EQUIPMENT. KEEP YOUR FACE AND HANDS AWAY FROM THE OPENING!

Notice. This AFQTP is NOT intended to replace the applicable technical references nor is it intended to replace hands-on training. It is to be used in conjunction with these for training purposes only.

Review Questions
for
Perform Operational Tests for Model 1941 Type I

| Question | Answer |
|---|--|
| 1. What is the position of the flue damper when you begin the operational test? | a. Open position b. Closed position c. Half open d. Half closed |
| 2. How is the heat output regulated? | a. By closing ash pit door b. By closing ash pit door halfway c. By turning the damper in smoke pipe d. All the above |
| 3. When operating the type I tent heater, how high should you add coal on the grate? | a. 3 inches b. 7 inches c. 10 inches d. 4 inches e. |
| 4. You remove ashes and clinkers from the grate assembly by pushing the draw gate gently back and forth with shaker until a faint red glow appears. | a. True b. False |

Notice. This AFQTP is NOT intended to replace the applicable technical references nor is it intended to replace hands-on training. It is to be used in conjunction with these for training purposes only.

Review Questions
for
Perform Operational Tests for Model 1941 Type II

| Question | Answer |
|--|---|
| 1. How long will 5 gallons of fuel last at maximum heat output? | a. Nearly 8 hours b. Nearly 17 hours c. Nearly 12 hours d. Nearly 4 hours |
| 2. Name the parts that make up the heater base. | a. It consists of a steel pot with an adapter ring. b. Oil-pot burner c. Cast iron flame spreader, and fuel inlet nipple with reducer d. All the above |
| 3. What is used to connect the float valve to the reducer of the heater base? | a. 1/8 inch nipple b. 1/2 inch nipple c. 2/3 inch nipple d. 3/4 inch nipple |
| 4. What is the first step in starting the type II tent heater? | Written Answer |
| 5. What does the float valve of the oil burner provide? | Written Answer |
| 6. During startup, what is the position of the ON-OFF valve knob and the flow adjustment knob? | Written Answer |
| 7. How much time should pass before you set the adjustment knob to the size flame desired? | Written Answer |
| 8. If the flame is accidentally extinguished, what should you do? | Written Answer |

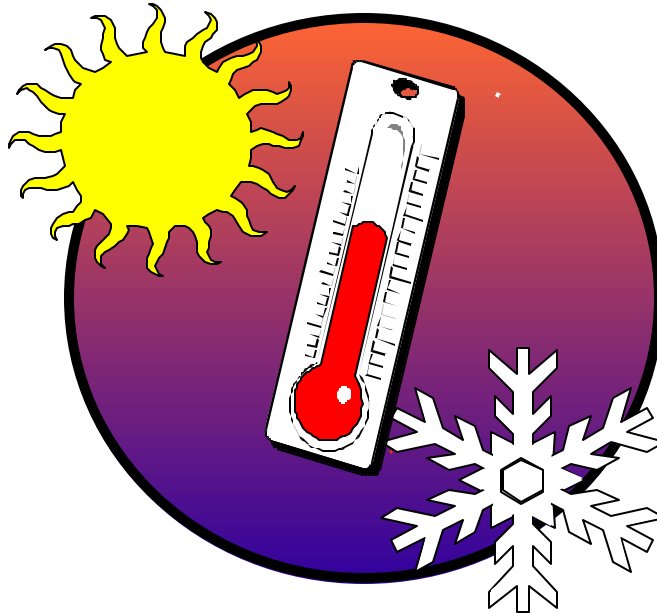
Notice. This AFQTP is NOT intended to replace the applicable technical references nor is it intended to replace hands-on training. It is to be used in conjunction with these for training purposes only.

PERFORM OPERATIONAL TESTS

| Performance Checklist | | |
|---|-----|----|
| Step | Yes | No |
| 1. Did the trainee visually inspect heaters for proper setup? | | |
| 2. Did the trainee successfully start the heaters correctly? | | |
| 3. Did the trainee shut down heaters correctly? | | |
| 4. Did the trainee prime the preway heater correctly? | | |

FEEDBACK: Trainer should provide both positive and/or negative feedback to the trainee immediately after the task is performed. This will ensure the issue is still fresh in the mind of both the trainee and trainer.

Notice. This AFQTP is NOT intended to replace the applicable technical references nor is it intended to replace hands-on training. It is to be used in conjunction with these for training purposes only.



150 CUBIC FOOT REFRIGERATION UNIT

MODULE 27

AFQTP UNIT 2

CONDUCT PRE-OPERATIONAL TESTS

(27.2.2.2.1.)

Notice. This AFQTP is NOT intended to replace the applicable technical references nor is it intended to replace hands-on training. It is to be used in conjunction with these for training purposes only.

CONDUCT PRE-OPERATIONAL TESTS***Task Training Guide***

| | |
|--|---|
| STS Reference Number/Title: | 27.2.2.2.1. Conduct Pre-operational Tests |
| Training References: | <ul style="list-style-type: none"> • CD-ROM 3E1X1-27.2.2.2 Ver. 1.0 150 Cubic Foot Refrigerator QTP. |
| Prerequisites: | <ul style="list-style-type: none"> • Possess as a minimum a, 3E131 AFSC. |
| Equipment/Tools Required: | <ul style="list-style-type: none"> • Personnel Protective equipment • Standard HVAC/R Toolbag |
| Learning Objective: | <ul style="list-style-type: none"> • Trainee should know the steps required to safely perform a pre-operational test of a 150 Cubic Foot Refrigerator. |
| Samples of Behavior: | <ul style="list-style-type: none"> • Trainee should be able to identify the required items to be inspected during a pre-operational inspection of a 150 Cubic Foot Refrigerator. |
| Notes: | |
| <ul style="list-style-type: none"> • This task is covered in the computer-based QTP, “150 Cubic Foot Refrigerator” 27.2.2.2. • Any safety violation is an automatic failure. | |

To perform this task, view AFQTP 3E1X1-27.2.2.2 Version 1.0 150 Cubic Foot Refrigerator CD-ROM.

NOTE:

In the CD-ROM there are tests after each section. Complete each section and answer the questions.

CerTest numbers 8065, 8066, 8067, 8068, and 8069 are mandatory for this task.

HINT: To increase the chances of obtaining a passing score, recommend you take each corresponding CerTest after you complete a section. Contact your UETM to schedule testing.

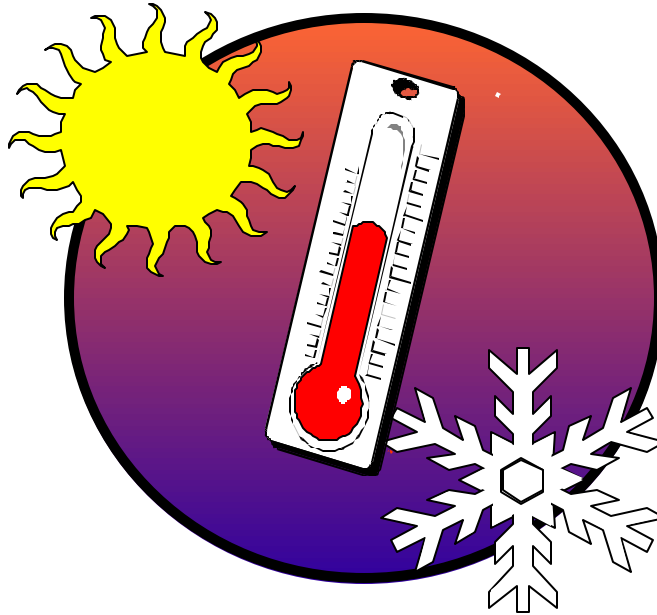
Notice. This AFQTP is NOT intended to replace the applicable technical references nor is it intended to replace hands-on training. It is to be used in conjunction with these for training purposes only.

PERFORM OPERATIONAL TESTS

| Performance Checklist | | |
|--|-----|----|
| Step | Yes | No |
| 1. Did the trainee conduct the Pre-operational test? | | |

FEEDBACK: Trainer should provide both positive and/or negative feedback to the trainee immediately after the task is performed. This will ensure the issue is still fresh in the mind of both the trainee and trainer.

Notice. This AFQTP is NOT intended to replace the applicable technical references nor is it intended to replace hands-on training. It is to be used in conjunction with these for training purposes only.



BARE BASE AIR CONDITIONER

MODULE 27

AFQTP UNIT 2

SET-UP

(27.2.2.3.1.)

Notice. This AFQTP is NOT intended to replace the applicable technical references nor is it intended to replace hands-on training. It is to be used in conjunction with these for training purposes only.

SET-UP

Task Training Guide

| | |
|---|---|
| STS Reference Number/Title: | 27.2.2.3.1. Set-up |
| Training References: | <ul style="list-style-type: none">• CD-ROM 3E1X1-27.2.2.3C Ver. 1.0 Air Conditioner Bare Base |
| Prerequisites: | <ul style="list-style-type: none">• Possess as a minimum a, 3E131 AFSC. |
| Equipment/Tools Required: | <ul style="list-style-type: none">• Personnel Protective Equipment• Standard HVAC/R Toolbag |
| Learning Objective: | <ul style="list-style-type: none">• Trainee should know the steps required to safely perform the setup of a Bare Base Air Conditioner. |
| Samples of Behavior: | <ul style="list-style-type: none">• Trainee should be able to safely perform the setup of Bare Base Air conditioner.• Trainee should be able to identify the specific components of a Bare Base Air Conditioner. |
| Notes: | |
| <ul style="list-style-type: none">• The tasks are covered in the computer-based QTP, “<u>Bare Base Air Conditioner</u>” 27.2.2.3.• Any safety violation is an automatic failure. | |

To perform this task, view AFQTP 3E1X1-27.2.2.3C Version 1.0 Air Conditioner Bare Base CD-ROM.

NOTE:

The CD-ROM covers both 27.2.2.3.1 and 27.2.2.3.2. Complete both tasks before accomplishing the mandatory CerTest 8084. Contact your UETM to schedule testing.

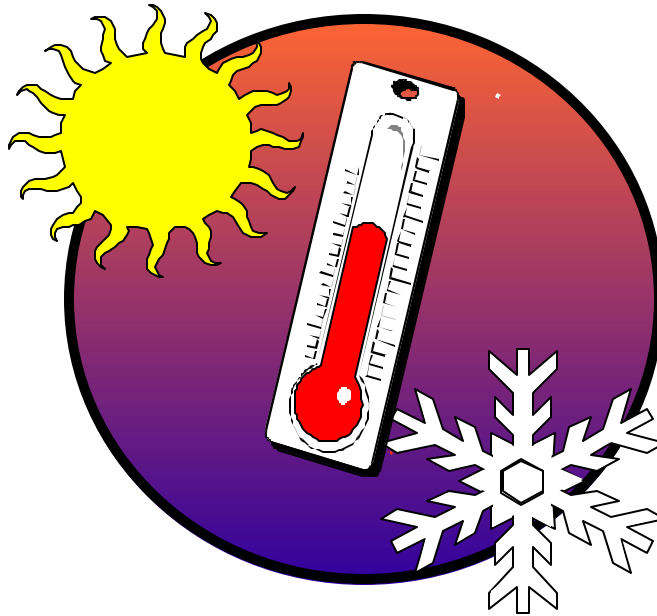
Notice. This AFQTP is NOT intended to replace the applicable technical references nor is it intended to replace hands-on training. It is to be used in conjunction with these for training purposes only.

SETUP

| Performance Checklist | | |
|---|-----|----|
| Step | Yes | No |
| 1. Did trainee properly perform Set-up? | | |

FEEDBACK: Trainer should provide both positive and/or negative feedback to the trainee immediately after the task is performed. This will ensure the issue is still fresh in the mind of both the trainee and trainer.

Notice. This AFQTP is NOT intended to replace the applicable technical references nor is it intended to replace hands-on training. It is to be used in conjunction with these for training purposes only.



BARE BASE AIR CONDITIONER

MODULE 27

AFQTP UNIT 2

PERFORM OPERATIONAL TESTS

(27.2.2.3.2.)

Notice. This AFQTP is NOT intended to replace the applicable technical references nor is it intended to replace hands-on training. It is to be used in conjunction with these for training purposes only.

PERFORM OPERATIONAL TESTS

Task Training Guide

| | |
|---|--|
| STS Reference Number/Title: | 27.2.2.3.2. Perform Operational Tests |
| Training References: | <ul style="list-style-type: none">• CD-ROM 3E1X1-27.2.2.3C Ver. 1.0 Air Conditioner Bare Base |
| Prerequisites: | <ul style="list-style-type: none">• Possess as a minimum a, 3E131 AFSC. |
| Equipment/Tools Required: | <ul style="list-style-type: none">• Personnel Protective Equipment• Standard HVAC/R Toolbag |
| Learning Objective: | <ul style="list-style-type: none">• Trainee should know the steps required to safely perform the operational test of a Bare Base Air Conditioner. |
| Samples of Behavior: | <ul style="list-style-type: none">• Trainee should be able to safely perform the operational test of a Bare Base Air conditioner.• Trainee should be able to identify the specific components of a Bare Base Air Conditioner. |
| Notes: | |
| <ul style="list-style-type: none">• The tasks are covered in the computer-based QTP, “<u>Bare Base Air Conditioner</u>” 27.2.2.3.• Any safety violation is an automatic failure. | |

To perform this task, view AFQTP 3E1X1-27.2.2.3C Version 1.0 Air Conditioner Bare Base CD-ROM.

NOTE:

The CD-ROM covers both 27.2.2.3.1 and 27.2.2.3.2. Complete both tasks before accomplishing the mandatory CerTest 8084. Contact your UETM to schedule testing.

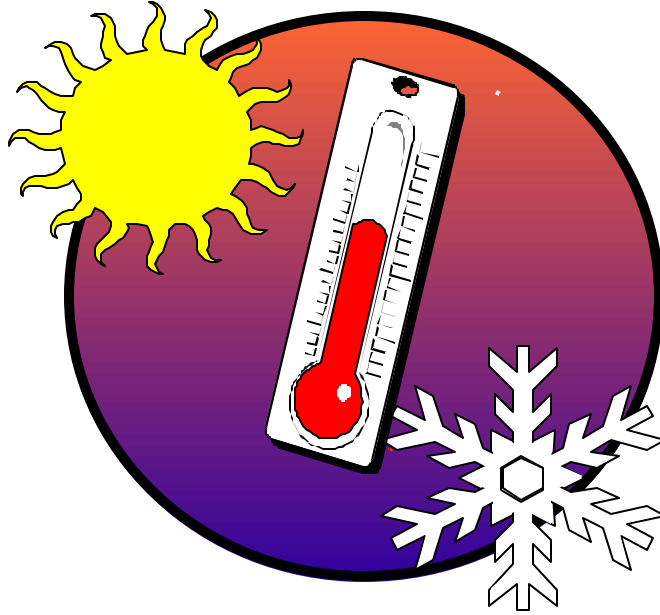
Notice. This AFQTP is NOT intended to replace the applicable technical references nor is it intended to replace hands-on training. It is to be used in conjunction with these for training purposes only.

PERFORM OPERATIONAL TEST

| Performance Checklist | | |
|---|-----|----|
| Step | Yes | No |
| 1. Did the trainee perform the operational test properly? | | |

FEEDBACK: Trainer should provide both positive and/or negative feedback to the trainee immediately after the task is performed. This will ensure the issue is still fresh in the mind of both the trainee and trainer.

Notice. This AFQTP is NOT intended to replace the applicable technical references nor is it intended to replace hands-on training. It is to be used in conjunction with these for training purposes only.



LIGHTWEIGHT DECONTAMINATION UNIT

MODULE 27

AFQTP UNIT 3

PERFORM OPERATIONAL TESTS

(27.3.1.1.)

Notice. This AFQTP is NOT intended to replace the applicable technical references nor is it intended to replace hands-on training. It is to be used in conjunction with these for training purposes only.

PERFORM OPERATIONAL TESTS

Task Training Guide

| | |
|---|--|
| STS Reference Number/Title: | 27.3.1.1. Perform Operational Test |
| Training References: | <ul style="list-style-type: none"> • T.O.s 11D-1-3-9-1 • T.O.s 11C15-1-3 • Study Guide Workbook, J3ABR3E131 003-VII-1-4 |
| Prerequisites: | <ul style="list-style-type: none"> • Possess as a minimum a, 3E131 AFSC. |
| Equipment/Tools Required: | <ul style="list-style-type: none"> • Personal Protective Equip / Clothing • Extra Heavy leather or Fireman's gloves • Standard tool Bag • Gallon Trash Can and Decontamination Solution |
| Learning Objective: | <ul style="list-style-type: none"> • The trainee should know the steps required to safely perform an operational test on the Lightweight Decontamination Unit (M-17 LDU). |
| Samples of Behavior: | <ul style="list-style-type: none"> • Trainee should be able to identify the required items to be attached and should be able to safely conduct an operational test of the M-17 LDU. • Trainee should be able to conduct the shut down of the M-17 LDU safely after the Operational test. |
| Notes: | |
| <ul style="list-style-type: none"> • To successfully complete this element, the steps must be followed exactly. • Any safety violation is an automatic failure. | |

NOTE:

CerTest number 8076 is mandatory for tasks 27.3.1.1, 27.3.1.2, 27.3.1.3 and 27.3.1.4. Complete all tasks prior to accomplishing the mandatory CerTest.

PERFORM OPERATIONAL TESTS

Background: During an actual contingency operation you may be called upon to operate and conduct maintenance checks/services of the Lightweight Decontamination Unit. The M-17 LDU is a self-contained water heating apparatus used in the decontamination of equipment and material exposed to nuclear, biological, or chemical agents. The LDU uses water and water mixed with a decontaminating agent to rid equipment, material, and personnel of contaminants. The LDU also can be used as a field shower for personnel in a bare base setup.

Notice. This AFQTP is NOT intended to replace the applicable technical references nor is it intended to replace hands-on training. It is to be used in conjunction with these for training purposes only.

The M-17 LDU will be shipped with a collapsible storage tank, approx. 1,500 to 3,000 gallons size. This storage tank will be used to hold uncontaminated water for use in any of the three modes of operation, wands, injectors, and showers.

To perform this task, follow these steps:

Step 1: Assembly.

- Prior to operating the M-17 LDU some assembly will be required. Two general areas of concerns that will be discussed are the water tank with associated piping and the fuel tanks and their connections.

Water Tank / Hose Connections.

- The collapsible water tank must be handled with care. Do not pull, drag or walk on the tank during setup. The water tank will be used when a natural water source is not readily available. After setup, fill the tank from any available water source. If the water source is located in a remote location you can also fill the tank using a centrifugal pump and hose kit listed in the technical manual for the M-17 LDU. (See Figure 1). Also during setup, when filling this tank ensure the top collar of the tank does not collapse. Once water starts to fill this tank, only one attendant is needed to ensure proper filling.

Suction Hose Connection.

- If a shallow natural water source is used, place one end of the suction hose with strainer in the canvas pail accompanying the unit. The pail and strainer must be positioned to prevent entry of foreign matter. With deep natural water source is used secure a float to the suction hose strainer. Place the suction hose strainer and float in the water. The strainer should be positioned about 12 inches below the water surface.

NOTE:

To prevent damage to the water pump, do not place the suction hose strainer directly in sand, mud, or silt, and do not allow the strainer to rest on any bottom. After connection is made to the water source, connect the suction hose to the water inlet coupling on the M-17 LDU. (Figure 1).

Pressure Hose Connection.

- Position the branch hose so that the strainer body is resting on the ground. Connect the pressure hose to the water outlet coupling on the LDU. (Figure 2).

Branch Hose Connection.

- When only one branch hose will be used, the quick disconnect plug must be connected to the open outlet on the tee fitting at the end of the pressure hose. If both branch hoses are to be connected, the disconnect plug must be removed. (Figure 2)

Spray Wand Connection.

Notice. This AFQTP is NOT intended to replace the applicable technical references nor is it intended to replace hands-on training. It is to be used in conjunction with these for training purposes only.

- Connect the pressure hose from the branch line outlet tee coupling, to the camlock coupling on the spray wand. Repeat when using both spray wands. (Figure 2)

SAFETY:

AS A SAFETY PRECAUTION, ALWAYS ENSURE THE SPRAY WANDS ARE SECURED DURING OPERATION. SEVERE INJURY MAY RESULT IF ACCESSORIES DETACH DURING USE. ALSO, THE SPRAY WANDS WILL BECOME EXTREMELY HOT AFTER TWO MINUTES OF OPERATION. TO PREVENT INJURY, ALWAYS WEAR PROTECTIVE GLOVES WHEN OPERATING

Injector Connection.

- Connect the pressure hose from the branch line outlet tee coupling, to the camlock coupling on the injector assembly.
- Water flow from the unused side of the branch hose must be blocked off by connecting either a quick disconnect dust plug or a pressure hose with a spray wand attached.
- Insert one end of the clear plastic siphon tube into a container filled with decontaminate.
- During operation of the injector, the clear hose may begin to collapse if not properly supported or if allowed to bend or kink. (Figure 2).

Shower Assembly.

- Each shower bar contains three separate pieces; one end section, a middle section, and another shower end section with a hose connected. Connect the shower end sections to the middle sections. Connect a pressure hose from the branch line connection to the shower piece end without a hose. If required, loosen the camlock couplings and rotate the shower sections to reposition the shower streams. Mount the assembled shower sections on a support device to hold the shower bars at least 7 feet above the ground (i.e. tree or post or as directed by local authorities). Repeat steps for the other shower bar assembly. (Figure 3).

Notice. This AFQTP is NOT intended to replace the applicable technical references nor is it intended to replace hands-on training. It is to be used in conjunction with these for training purposes only.

Fuel Tanks.

- When handling fuels, it is essential that the following safety rules be followed. The following safety precautions pertain to both engine and heater fuel systems.

SAFETY:

- **DO NOT SMOKE WHEN MIXING FUEL.**
- **DO NOT FILL FUEL CANS PAST TOP WELD LINE, AS IT MAY LEAK, ALSO TO ALLOW FOR EXPANSION OF THE FUEL.**
- **DO NOT ALLOW FLAME PRODUCING MATERIAL WITHIN 50 FEET DURING FUELING.**
- **ALL FUELS DAMAGE THE CHEMICAL WARFARE PROTECTIVE CLOTHING. TO PREVENT CONTAMINATION, DO NOT LET FUEL TOUCH THE CHEMICAL WARFARE PROTECTIVE CLOTHING.**
- **REMOVE FUEL CANS FROM PUMP HEATER ASSEMBLY AND PLACE IT ON THE GROUND DURING FUELING.**

- Mix fuel in a well-ventilated area, preferably outside.

Engine Fuel System

- The correct mixture of fuel for the two-cycle engine is one quart of two-cycle oil to five gallons of leaded or unleaded gasoline. After adding two-cycle oil with gasoline, shake the fuel container vigorously to mix the fuel well. Failure to follow the mixing ratios may result in damage to the engine. The engine should run seven hours on five gallons of fuel.

NOTE:

- In the event two-cycle oil is not available, use SAE 30 non-detergent oil. Do not use multi-grade oils or other automotive oils that contain large amounts of detergents.
- To install fuel can for the engine, extend the engine fuel can storage tray.
- Remove engine fuel lid assembly with gasket from storage area located below the engine.
- Remove the engine fuel can lid. Install the engine fuel lid assembly and gasket on the fuel can. Make sure the lid assembly is securely connected.
- Carefully position the fuel can on the storage tray.
- Verify that the arrow labeled on the body of the engine fuel filter is pointing away from the gall pump, (See Figure 4) for above steps.

Heater Fuel System

- The heater uses a variety of fuels. The burner will be primary fueled by, leaded or unleaded gasoline. Alternate fuels include: kerosene, jet fuel, diesel fuel, or any mixture of these. The burner will operate about one-half hour on five gallons of fuel. The following steps are to be used in filling and installing the heater fuel can.

Notice. This AFQTP is NOT intended to replace the applicable technical references nor is it intended to replace hands-on training. It is to be used in conjunction with these for training purposes only.

- With the heater fuel can removed and positioned well away from the equipment, fill the can with five gallons of fuel (diesel or Mogas.). Do not fill above the weld line. Re-install the heater fuel can lid.
- Remove the heater fuel lid assembly from the toolbox. Be sure the gasket is present.
- Mount the full heater fuel can on the frame hanger.
- Check the strainer on the inside of the suction line for clogging. Then secure assemble to the fuel can. (Figure 4).

Step 2: Engine Starting.

- Prior to using the M-17 LDU, all operators should be completely familiar with the operating mode before using the equipment. After becoming familiar with the operating procedures the following steps are used to start the unit, also ensure all safety notes are followed.

SAFETY:

TO PREVENT DAMAGE TO PERSONNEL OR EQUIPMENT, OBSERVE THE FOLLOWING:

- **DO NOT PRIME THE CARBURETOR WHEN THE ENGINE IS HOT.**
- **THE EXHAUST OPENING EMITS CARBON MONOXIDE. DO NOT STAND BEHIND THE EXHAUST OPENING. STAY UP WIND OF EXHAUST GASES. OPERATE THE LDU IN A WELL-VENTILATED AREA.**
- **THE EQUIPMENT CAN GET VERY HOT DURING OPERATION. DO NOT TOUCH HOT SURFACES. ALWAYS WEAR PROTECTIVE GLOVES WHEN OPERATING THE SPRAY WANDS WITH HOT WATER / STEAM.**
- **SECURE THE ENDS OF PRESSURE HOSES BEFORE STARTING THE M-17 LDU. THE HOSES CAN WHIP AROUND DANGEROUSLY WHEN THE UNIT IS FIRST STARTED.**

Function Selector Switch.

- Set FUNCTION SELECTOR switch to off. See Figure 5 for Engine starting.

Burner Control Valve.

- Turn BURNER FUEL VALVE control fully clockwise.

NOTE:

If water hoses and pump do not contain water, such as during initial start up, remove accessories from pressure hoses. Water pump cannot prime against air trapped in the hoses.

Engine Throttle.

- Set engine throttle to one-third MAX.

Notice. This AFQTP is NOT intended to replace the applicable technical references nor is it intended to replace hands-on training. It is to be used in conjunction with these for training purposes only.

Carburetor Priming.

- Before starting, prime the carburetor by depressing the tickler while squeezing fuel line ball pump until fuel drips from carburetor onto drain plate. If tickler does not extend when released, pull tickler up to stop fuel flow to carburetor float bowl.

Notice. This AFQTP is NOT intended to replace the applicable technical references nor is it intended to replace hands-on training. It is to be used in conjunction with these for training purposes only.

Choking Requirement.

- If choking is required press choke lever down. Open the choke when the engine begins to run (TM3-4230-228-10) and close it in short bursts until the engine runs smoothly. If choking is not required, verify that the engine choke lever is in full open position (up).

Starter Handle.

- Pull starter handle slowly until starter engages engine. Then, pull firmly and sharply. Repeat until engine starts. After engine has started and is running smoothly, push throttle down to MAX.

NOTE:

Sub step (1) in Step 3, must be done as soon as the engine is running.

Step 3: Water Pressure.**SAFETY:**

FIRST START: PERFORM THE FOLLOWING STEPS ONLY IF IT IS THE FIRST START OF THE DAY AND ANYTIME THE SPRAY WANDS ARE USED. IF IT IS NOT THE FIRST START PROCEED TO THE STEPS FOR BURNER IGNITION.

PUMP DAMAGE: DO NOT OPERATE MORE THAN ONE MINUTE WITHOUT LIQUID FLOW. SHUT DOWN THE UNIT TO PREVENT DAMAGE TO THE EQUIPMENT.

Normal Operating Pressures.

- Water pressure is automatically maintained and normal water pressures are: Wands - 110 to 130 psi; injector - 70 to 90 psi; and shower - 40 to 50 psi. With the function selector switch in the **OFF** position normal fluid pressures should be at least 40 psi for water and 95 to 105 psi for fuel. (Figure 6).
- Prime pump and establish water flow from hoses. Throttle the engine to idle speed by raising the throttle lever. This will bring the water pump pulley to a stop (rotating).
- Reconnect wands to pressure hoses.
- Verify that Function **SELECTOR** switch is OFF.
- Push engine throttle to **MAX.**, and watch gauges to ensure proper pressure is reached.

Notice. This AFQTP is NOT intended to replace the applicable technical references nor is it intended to replace hands-on training. It is to be used in conjunction with these for training purposes only.

Step 4: Burner Ignition.

- The following procedures are used to ignite the burner in the wands, injector, and shower modes. Before setting the function selector switch, verify that the following conditions exist: The burner automatically ignites when water is flowing and the function selector switch is set to either the shower or wands position. When the switch is set to showers the burner will not ignite if the water temperature is 90 F (32 C) or more. Burner operation will produce a load rumble and hot exhaust gases will vent from the heat exchanger exhaust opening.

Refer to (Figure 6) for all steps below.

Burner Control Valve.

- Burner fuel valve must be in the fully clockwise position.
- Wands Mode - The burner control valve is always in the fully clockwise position when used in the wands mode.
- Shower Mode - It may become necessary to adjust the burner control valve in the shower mode.

Water Pressure.

- Ensure that at least 40 psi is indicated before burner ignition.

Fuel Pressure.

- Ensure that the gauge indicates 95 to 105 psi. if it is the first start of the day, the heater fuel filter may be empty causing the fuel pressure indication to fluctuate and causing the Reset indicator to light until the heater fuel system pressure stabilizes.

Operating Temperatures.

- Wands Mode: The following procedures are used to start burner ignition in the Wands mode:
- Set the function selector to the wands position. The burner will ignite automatically when the spray wand trigger is squeezed and water begins to flow.
- Ensure that the Reset indicator light is not on. If the light is on, the burner did not ignite. Depress the Reset indicator. This action should allow the burner to ignite. If after three unsuccessful attempts to ignite the burner, begin troubleshooting procedures.
- While operating the unit ensure that the burner cycles off at about 250 F/ 120C and automatically re-ignites when the water temperature drops to about 212 F/ 100C. Injector Mode: The following procedures are used to start burner ignition in the Injector mode.
- Set the function selector to wands, the burner will automatically ignite.

Notice. This AFQTP is NOT intended to replace the applicable technical references nor is it intended to replace hands-on training. It is to be used in conjunction with these for training purposes only.

- Ensure that the Reset indicator light is not on. If the light is on, the burner did not ignite. Depress the Reset indicator. This action should allow the burner to ignite. If after three unsuccessful attempts to ignite the burner, begin troubleshooting procedures.
- To draw decontaminate from a container during operation, rotate the control valve handle towards the clear intake tube to begin siphoning the agent. Water flow from the pump/heater never stops regardless of the position of the control valve handle. The handle starts and stops the siphon action only.

Shower Mode.

The following procedures are used to start burner ignition in the showers mode:

- Set the function selector to the shower position. The burner automatically ignites.
- Ensure that the Reset indicator light is not on. If the light is on, the burner did not ignite. Depress the Reset indicator. This action should allow the burner to ignite. If after three unsuccessful attempts to ignite the burner, begin troubleshooting procedures.
- Ensure the burner is not cycling excessively, but rather maintaining a constant temperature below 113 F (45 C). If there is excessive cycling, slowly rotate the burner fuel valve counterclockwise, as required, until the water temperature is maintained below 113 F. An acceptable temperature range for the shower mode is between 90 F and 113 F. (32 C).

Step 5: Shut Down.

- To shut the M-17 LDU down when your mission is complete, or if refueling must be accomplished, follow the steps listed below. (Figure 6)

Burner Control Valve.

- Ensure that the burner fuel valve control is fully clockwise.

Function Selector Switch.

- Set the function selector switch to the OFF. If spray wands or injector were used during operation, squeeze spray wand triggers and allow the engine to run and water pump to circulate until WATER TEMPERATURE gauge (11) indicates less than 104 F (40 C).

Cooldown.

- If showers were used during the operation, allow the engine to run and continue circulating water for two minutes before proceeding to the next step.

Notice. This AFQTP is NOT intended to replace the applicable technical references nor is it intended to replace hands-on training. It is to be used in conjunction with these for training purposes only.

Decontaminant.

- Then the injector is used, place the end of the clear siphon hose in a container of clean water. Position the control valve handle to begin siphoning the rinse water. Allow the injector to continue drawing water until the decontaminant is purged TO11D1-3-9-1,2-4(3) from the system. Allow the engine to run and continue circulating water for two minutes.

Throttle Position.

- Hold the throttle lever in the up position until the engine stops. If the engine does not stop, use the emergency stop switch.

Spray Wands.

- If spray wands were used, press the trigger(s) to relieve system water pressure before disassembling the hoses.

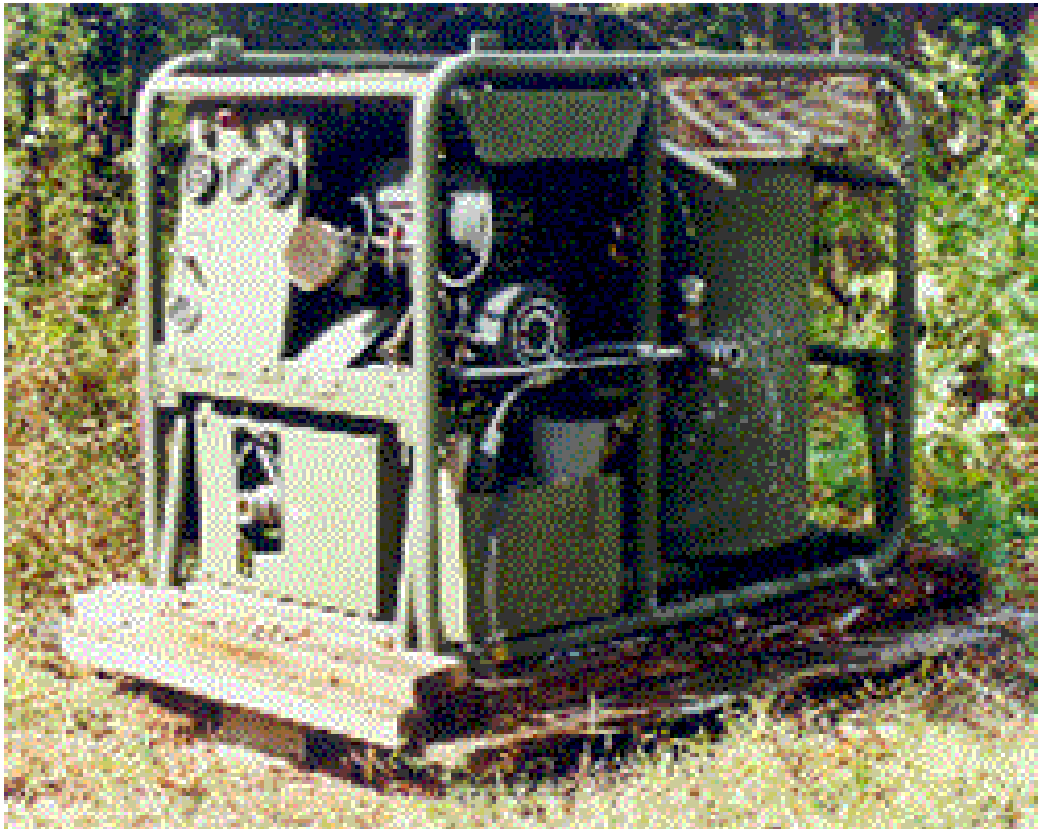


Figure 1, Lightweight Decontamination Unit (LDU)

Notice. This AFQTP is NOT intended to replace the applicable technical references nor is it intended to replace hands-on training. It is to be used in conjunction with these for training purposes only.

**Review Questions
for
Perform Operational Tests**

| Question | Answer |
|--|----------------|
| 1. What is the purpose of the M-17 LDU? | Written Answer |
| 2. What are the three modes of operation? | Written Answer |
| 3. When using the M-17 LDU, when does the burner ignite? | Written Answer |
| 4. What type of fuel does the engine use? | Written Answer |
| 5. What are the maximum and minimum temperature settings for the various modes of operation? | Written Answer |

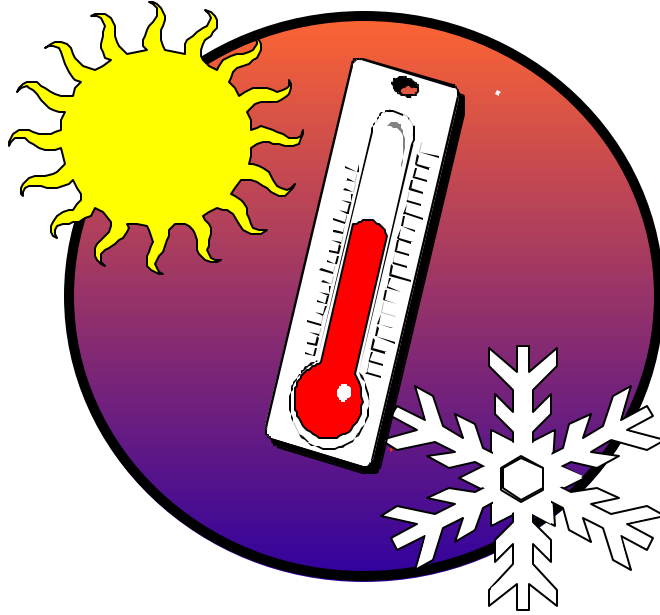
Notice. This AFQTP is NOT intended to replace the applicable technical references nor is it intended to replace hands-on training. It is to be used in conjunction with these for training purposes only.

PERFORM OPERATIONAL TESTS

| Performance Checklist | | |
|---|------------|-----------|
| Step | Yes | No |
| 1. Did the trainee assemble Lightweight Decontamination Unit correctly? | | |
| 2. Did the trainee follow correct procedures for engine starting? | | |
| 3. Did the trainee correctly prime water pump? | | |
| 4. Did the trainee correctly ignite burner? | | |
| 5. Did the trainee follow shutdown procedures? | | |

FEEDBACK: Trainer should provide both positive and/or negative feedback to the trainee immediately after the task is performed. This will ensure the issue is still fresh in the mind of both the trainee and trainer.

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LIGHTWEIGHT DECONTAMINATION UNIT

MODULE 27

AFQTP UNIT 3

SERVICE/PERIODIC MAINTENANCE

(27.3.1.2.)

Notice. This AFQTP is NOT intended to replace the applicable technical references nor is it intended to replace hands-on training. It is to be used in conjunction with these for training purposes only.

SERVICE/PERIODIC MAINTENANCE

Task Training Guide

| | |
|---|--|
| STS Reference Number/Title: | 27.3.1.2. Service/Periodic Maintenance |
| Training References: | <ul style="list-style-type: none"> • T.O. 11D-1-3-8-1 • T.O. 11C15-1-3 • Study Guide Workbook, J3ABR3E131 003-VII-1-4 |
| Prerequisites: | <ul style="list-style-type: none"> • Possess as a minimum a, 3E131 AFSC. |
| Equipment/Tools Required: | <ul style="list-style-type: none"> • Personal Protective Equip/Clothing • Extra Heavy leather or Fireman's gloves • Standard tool bag |
| Learning Objective: | <ul style="list-style-type: none"> • The trainee should know the procedures and instructions necessary to perform checks and periodic maintenance before, during, and after operation of the M-17 LDU. |
| Samples of Behavior: | <ul style="list-style-type: none"> • Trainee should be able to conduct proper checks and periodic maintenance during all phases of operation for the M-17 LDU. • Trainee should ensure all main and attached items are safely installed and handled during these periodic inspections. |
| Notes: | |
| <ul style="list-style-type: none"> • To successfully complete this element, the steps must be followed exactly. • Any safety violation is an automatic failure. | |

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SERVICE/PERIODIC MAINTENANCE

Background: During an actual contingency operation you may be called upon to operate and conduct maintenance checks/services of the Lightweight Decontamination Unit. The LDU is a self-contained water heating apparatus used in the decontamination of equipment and material exposed to nuclear, biological, or chemical agents. The LDU uses water and water mixed with a decontaminating agent to rid equipment, material, and personnel of contaminants. The LDU also can be used as a field shower for personnel in a bare base setup.

Information:

- Purpose of Inspection. The checklist provided contains procedures and instructions necessary to perform Preventive Maintenance Checks and Services (PMCS). These services will be performed Before (B), During (D), and After (A) operation of the LDU.

Inspection Requirements.

- The Items number column tells which particular item is to be inspected. You will notice above several of the items to be inspected, there is a major component or assembly listed. This tells you which component or major assembly the item is used with. Example: **Pump Heater Assembly**.
- The interval column (B, D, and A) tells you when to do a certain check or service. Sometimes an **X** will be placed in more than one interval column, which would mean you should do the check or service at each of those intervals.
- The **Items Inspected** column identifies the item by their common names.
- The **Procedures** column briefly describes the procedure to be checked. It contains the information required to accomplish the checks and services, including appropriate tolerances, adjustments, and gauge readings.

SAFETY:

WITH THIS PIECE OF EQUIPMENT IT IS A MUST TO WEAR PERSONAL PROTECTIVE EQUIPMENT AND CLOTHING, I.E. HEAVY GLOVES, EAR PLUGS AND SAFETY GOGGLES TO PREVENT INJURIES. ALSO, ENSURE ANY FLAMMABLE ITEMS, NOT IN USE WITH THIS EQUIPMENT, ARE OUTSIDE THE 50 FOOT DISTANCE OF THE M-17 LDU.

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INSPECTION CHECKLIST

| ITEM # | B | D | A | ITEM INSPECTED | PROCEDURE |
|---|---|---|---|---------------------------|--|
| 1 | X | | | M-17 LDU See Example 1 | Inspect entire unit for physical damage. Check all major components. |
| Pump Heater Assembly Figure 2 | | | | | |
| 2 | X | | | Frame Assembly | Inspect for cracked or bent frame. |
| 3 | X | | X | Panels and Guards | Inspect for cracks, dents or tears. Check for missing fasteners. |
| ITEM # | B | D | A | ITEM INSPECTED | PROCEDURE |
| 4 | X | | X | Hardware | Inspect for loose or missing nuts, bolts, and screws. Tighten loose parts. NOTE: ENGINE MOUNTING BOLTS MUST REMAIN LOOSE |
| 5 | X | X | X | Burner Fuel Assembly | Inspect strainer, lid & gasket, and hose connections. |
| 6 | X | | X | Wiring | Inspect wiring for cuts, chaffing, or burns. |
| 7 | X | | | Starter | Check for missing or broken starter handle. Check that starter handle recoils when pulled. |
| 8 | X | | | Spark Plug | Inspect for cuts, broken or dirty spark plug wire. Check for secure cap connection. |
| 9 | X | X | X | Muffler | Inspect for holes or missing parts. Inspect for missing nuts on exhaust manifold. |
| 10 | X | | X | Air Filter | Verify that air filter is securely connected to the carburetor. Check for clogged filter screen, holes or cracks. |
| 11 | X | | X | Engine Mounts | Check for cracks, tears or deterioration of engine mounts. Check for loose, broken, or missing ground wire. |
| 12 | X | | | Burner Fuel Pump Belt | Check for loose, frayed, or missing belt. |
| 13 | X | | | Water Pressure Regulator | Verify that safety wire is installed on adjustment cap. |
| 14 | | | | High Voltage Tripler | WARNING: TO PREVENT ELECTRICAL SHOCK, DO NOT CLEAN HIGH VOLTAGE TRIPLER WHILE ENGINE IS RUNNING! ENGINE MUST BE SHUT DOWN! |
| 14a | X | | | | Check for dirt, dust, or soot on caps wire leads. Wipe off using a dry cloth. |
| 14b | X | | | | Inspect for cracks and tears. Verify secure connects of caps and wire leads. |
| 14c | X | | | | Remove, clean, and inspect burner igniter plug. |
| Engine Assembly Fuel System Figure 2 | | | | | |
| 15 | X | X | X | Fuel Hose | Inspect hose and ball pump for cracks or leaks. Inspect lid and gasket connection for leaks, cuts, or cracks. |
| 16 | X | X | X | Filter | Inspect for dirt, water, or sediment |
| 17 | X | | | Fuel Can Strainer | Inspect for tears or clogged strainer. Dislodge dirt or sediment, being careful not to damage screen. |

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INSPECTION CHECKLIST

| Heater Fluid Filter Figure 2 | | | | | |
|---------------------------------|---|---|---|----------------|--|
| 18 | X | | X | Fuel Filter | Inspect burner fuel filter for leaks or cracks. Inspect for dirt or water in glass bowl. Drain as follows: 1) Position container under drain plug. 2) Loosen plug and allow fuel to drain into container until contaminants are gone. 3) Tighten drain plugs and check for leaks. |
| ITEM # | B | D | A | ITEM INSPECTED | PROCEDURE |
| 19 | X | | X | Gauges | Inspect for cracked or leaking gauges. Be sure gauge temperature and operating mode temperature correlate. |
| 20 | X | | | Switches | Inspect for cracked or missing switches. Inspect for broken or missing override switch. |
| 21 | X | X | | Controls | Inspect for loose, broken, or missing burner fuel valve. |
| Water Inlet Figure 2 | | | | | |
| 22 | X | X | X | Fittings | Check for leaks and cracks. |
| 23 | | X | | Water Pump | Check for leaks |
| 24 | X | | | Pulley | Turn by hand to verify free rotation. |
| 25 | | X | | Hoses | Inspect for cuts, tears, and leaks. |
| 26 | X | | | Belts | Check for loose, broken, frayed, or missing drive pulleys. |
| 27 | X | | X | Water Outlet | Inspect for scale buildup. If more than 1/16" notify supervisor. |
| 28 | X | | | Accessory Kit | Check that all accessories are available. |
| Suction Hose Figure 2 | | | | | |
| 29 | X | | | Hose | Inspect for cracks, cuts, and tears. |
| 30 | X | | | Clamps | Check for loose or missing clamps. Tighten loose clamps. |
| 31 | X | X | | Couplings | Inspect for cracks, leaks, or missing gasket |
| 32a | X | | X | Strainer | Check for bent or missing basket. |
| 32b | X | | | | Inspect for clogged strainer. |
| 32c | | X | | | Inspect for basket placement. Ensure strainer basket is in the water but not resting on sand or silt. |
| Branch Hose Figure 2 | | | | | |
| 33 | X | | | Clamps | Check for loose or missing clamps. |
| 34 | X | X | | Couplings | Inspect for cracks, leaks, or missing gaskets. |
| 35 | X | X | X | Hose | Inspect for bulges, cuts, tears, and leaks. |
| Pressure Hose Figure 2 | | | | | |
| 36 | X | X | X | Hose | Inspect for cracks, cuts, tears, and leaks. |
| 37 | X | X | | Couplings | Inspect for cracks, leaks, and missing gaskets. |
| 38 | X | | X | Clamps | Check for loose or missing clamps. |

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INSPECTION CHECKLIST

| Shower Assembly Figure 2 | | | | | |
|-----------------------------|---|---|---|-----------------|--|
| 39 | X | | | Shower Sections | Ensure shower sections are available for use |
| 40 | X | | | Tubes/Jets | Inspect for bends, cracks, or missing jets. |
| 41 | X | | | Couplings | Check for cracks or damages. |
| 42 | X | | | Spray Wands | Inspect for bent or missing components. Verify that trigger is free moving and nozzle end rotates. |
| 43 | X | | | Injector | Inspect for cracks or missing components. Verify that valve turns freely, tubing is attached and clamps are tight. |
| Water Tank Figure 2 | | | | | |
| 44 | X | X | X | Tank/ Bladder | Inspect exterior for cuts, holes, and tears. Patch damaged areas with clamp patch kit. Check that component pouch is complete. |
| 45 | X | X | | Collar | Check for air leaks. Verify hand pump valve is closed (fully clockwise) |
| 46 | X | | X | Tool Kit | Check for broken, bent, or missing tools. Inspect pouch for cuts and tears. |

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Review Questions
for
Service/Periodic Maintenance

| Question | Answer |
|--|----------------|
| 1. When inspecting the hardware of the M-17 LDU, what is the most important item to check? | Written Answer |
| 2. What is the warning concerning the high voltage tripler? | Written Answer |
| 3. When should you inspect the filter in the fuel system of the engine assembly? | Written Answer |
| 4. What is done to the pulley on the water inlet? | Written Answer |
| 5. How much scale is allowed in the water outlet before notifying your supervisor? | Written Answer |

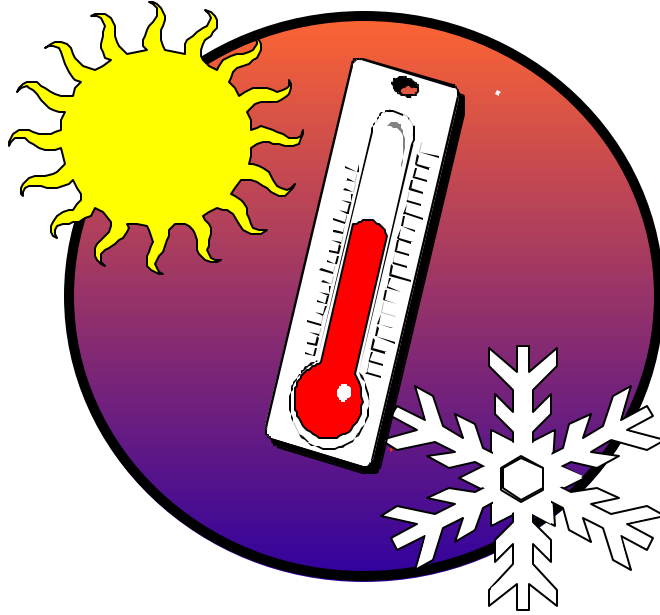
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SERVICE/PERIODIC MAINTENANCE

| Performance Checklist | | |
|--|------------|-----------|
| Step | Yes | No |
| 1. Did the trainee follow all checklists provided to perform preventive maintenance checks and services? | | |

FEEDBACK: Trainer should provide both positive and/or negative feedback to the trainee immediately after the task is performed. This will ensure the issue is still fresh in the mind of both the trainee and trainer.

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LIGHTWEIGHT DECONTAMINATION UNIT

MODULE 27

AFQTP UNIT 3

TROUBLESHOOT

(27.3.1.3.)

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TROUBLESHOOT

Task Training Guide

| | |
|---|--|
| STS Reference Number/Title: | 27.3.1. Troubleshoot |
| Training References: | <ul style="list-style-type: none"> • TO 11D1-3-9-1 • TO 11D1-3-9-2 |
| Prerequisites: | <ul style="list-style-type: none"> • Possess as a minimum a, 3E131 AFSC. |
| Equipment/Tools Required: | <ul style="list-style-type: none"> • Personal Protective Equipment/Clothing • Standard Tool Bag |
| Learning Objective: | <ul style="list-style-type: none"> • Trainee should know the steps to safely troubleshoot malfunctions on the Lightweight Decontamination Unit (LDU). |
| Samples of Behavior: | <ul style="list-style-type: none"> • Trainee should be able to troubleshoot a LDU. |
| Notes: | |
| <ul style="list-style-type: none"> • To successfully complete this element, the steps must be followed exactly. • Any safety violation is an automatic failure. | |

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TROUBLESHOOT

Background: A troubleshooter is defined as a worker who locates and eliminates sources of troubles. Troubleshooting then is locating and eliminating sources of trouble(s). When we as HVAC/R mechanics eliminate the source(s) of trouble, we must locate the original source of trouble. For example, when a motor overload trips, simply pushing the reset button is not considered locating the source or eliminating the source of the trouble. Something caused the motor current to rise and trip, or open, the protective device. The most important thing for you to remember is that you must ensure you have eliminated the source of the problem, not just a symptom of the problem. This is commonly known as finding the root of the problem.

During an actual contingency operation, you may be called on to operate a lightweight decontamination Unit. It may be for decontamination of personnel and equipment or it may be used as a field shower. In either case, if the LDU fails to operate it is vital to return a faulty unit back into operation as quickly as possible. It is important to become familiar with not only the operation of the devices but also the possible troubles that you may encounter on the LDU. This troubleshooting chart is set up to look at the easy problems and work toward the complicated ones, but no one chart can cover every problem that you may encounter. Therefore, through experience you will become more knowledgeable on the LDU and may not rely heavily on using the chart. Whenever you encounter a problem on the LDU that is not covered on the troubleshooting chart, you can determine the problem through a process of elimination. Keep the following functional areas in mind: engine, engine fuel system, electronic control system, air system, heater system, heater fuel system, and water system. Once you have determined what area your problem is in, look at your easy problems working toward the more complex.

Troubleshooting Checklist

ENGINE FAILS TO START

| STEP | TEST OR INSPECTION | CORRECTIVE ACTION |
|------|---|---|
| 1 | Check if engine turns, using recoil starter | <ul style="list-style-type: none"> • If engine is seized, perform engine block/cylinder repair procedures. • Possible faults are seized bearings, damaged rings/piston and broken connecting rod. Replace |
| 2 | Check for empty engine fuel can | <ul style="list-style-type: none"> • Fill with correct fuel/oil mixture |
| 3 | Check that throttle is set to 1/3 MAX | <ul style="list-style-type: none"> • Set to 1/3 MAX |
| 4 | Check for loose spark plug cap | <ul style="list-style-type: none"> • Push spark plug cap straight down onto spark plug until a firm connection is made. |

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Troubleshooting Checklist

| | | |
|-----------|--|---|
| 5 | If engine is cold or this the first start of the day, verify that the carburetor has been primed. | <ul style="list-style-type: none"> • Prime carburetor |
| 6 | Check position of carburetor choke | <ul style="list-style-type: none"> • Set choke to closed position if outside air temperature is cold or engine is cold. • Set choke to open position if engine is warm or outside air temperature is warm. |
| 7 | Check engine fuel filter. | <ul style="list-style-type: none"> • If filter is dirty or appears clogged, replace filter • If filter is not filled with fuel, prime system. |
| 8 | Check engine's fuel can strainer. | <ul style="list-style-type: none"> • If obstructed clean dirt and debris from strainer screen. • If strainer cannot be cleaned or is punctured, replace. • Ensure strainer is positioned at bottom of fuel supply. |
| 9 | Inspect engine fuel filter for signs of water. (Water will look like bubbles or a separate layer of liquid below the fuel) | <ul style="list-style-type: none"> • Drain fuel system and fill with fresh engine fuel mixture |
| 10 | Check for flooded engine by removing spark plug. | <ul style="list-style-type: none"> • If wet, allow to dry for a couple of minutes. Pull engine starter about five times to clear excessive fuel in engine. |
| 11 | Check for flooded/fouled spark plug looking for: <ul style="list-style-type: none"> • Excessive carbon build-up • Cracked insulator • Burned electrodes • Wet fuel deposits • Incorrect gap | <ul style="list-style-type: none"> • If excessive carbon build up; clean • If cracked insulator or burnt electrode; replace • If wet fuel deposits-allow plug to dry for a few minutes and pull engine start five times to clear and excessive fuel in engine. • If incorrect gap-gap using feeler gauge. |
| 12 | Check for damaged spark plug wire | <ul style="list-style-type: none"> • If damaged replace. |

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Troubleshooting Checklist

| | | |
|-----------|--|--|
| 13 | <p>Check for adequate spark: To check for adequate spark, connect spark plug cap to plug and press thread portion of plug to a good ground while pulling starter handle. Spark should be plainly visible and blue in color.</p> <p>Warning: Be sure not to touch plug or cap with bare hand. Failure to heed this warning may result in injury from electric shock.</p> | <ul style="list-style-type: none"> • If there is an inadequate spark or no spark at all, check emergency stop switch. |
| 14 | Check spark plug cap for cracks and dents | <ul style="list-style-type: none"> • Replace cap if damaged |
| 15 | <p>Check for fuel system vapor lock. (If outside air temperature is above 80 degrees F., look for partially full or large bubbles in engine fuel system filter.)</p> | <ul style="list-style-type: none"> • UN-vapor lock fuel system. |
| 16 | Check for defective/clogged fuel system by disconnecting fuel line at carburetor and operating ball pump. You should have a free flow of fuel from open hose. | <ul style="list-style-type: none"> • If fuel is adequate, service and adjust carburetor. |
| 17 | Check for fuel at fuel filter outlet, while squeezing ball pump. | <ul style="list-style-type: none"> • If fuel is adequate, replace engine fuel pump. |
| 18 | Check Emergency Stop Switch | <ul style="list-style-type: none"> • If continuity exists when switch is closed-replace. |
| 19 | <p>Check Ignition system for:</p> <ul style="list-style-type: none"> • Loose and bare wires • Pitted or incorrectly gapped points | <ul style="list-style-type: none"> • Replace defective wires or contact points. • If defective wire is part of coil, replace coil. |
| 20 | Check for open/shorted ignition coil | <ul style="list-style-type: none"> • If open or shorted replace coil |
| 21 | Check for shorted condenser | <ul style="list-style-type: none"> • If shorted replace condenser |
| 22 | Check ignition timing | <ul style="list-style-type: none"> • Time engine if necessary |

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Troubleshooting Checklist

ENGINE RUNS ERRATICALLY (STALLS OR STOPS)

| STEP | TEST OR INSPECTION | CORRECTIVE ACTION |
|------|--|---|
| 1 | Check fuel level in engine fuel can (Engine fuel strainer must be submerged in fuel can) | <ul style="list-style-type: none"> • Fill fuel can with correct engine fuel. • Submerge fuel strainer in fuel can. |
| 2 | Check for loose spark plug cap | <ul style="list-style-type: none"> • Push spark plug cap down onto spark plug until a firm connection is made. |
| 3 | Check position of carburetor choke. <ul style="list-style-type: none"> • Choke should be set to open position after engine reaches operating temperature. | <ul style="list-style-type: none"> • Open carburetor choke |
| 4 | Verify that engine throttle is set to MAX <ul style="list-style-type: none"> • (During normal operation, throttle should be set to maximum.) | <ul style="list-style-type: none"> • If not set to max throttle |
| 5 | Check for correct oil/fuel mixture. Note: If wrong OIL/fuel mixture OR too much oil was used, the engine will operate irregularly (overheat, smoke excessively, or stall/stop). | <ul style="list-style-type: none"> • If no presence of 2-cycle oil, drain and replace with appropriate mixture. • NOTE: If engine has ran too long with the wrong oil/fuel mixture, engine damage might have already occurred. |
| 6 | Check for clogged air filter | <ul style="list-style-type: none"> • If clogged replace |
| 7 | Check for clogged engine fuel can air vent. | <ul style="list-style-type: none"> • If clogged remove debris from fuel can lid assembly. |
| 8 | Inspect engine fuel filter for signs of water. (Water will look like bubbles or a separate layer of liquid below the fuel) | <ul style="list-style-type: none"> • Drain fuel system and fill with fresh engine fuel mixture |
| 9 | Check engine's fuel can strainer. | <ul style="list-style-type: none"> • If obstructed clean dirt and debris from strainer screen. • If strainer cannot be cleaned or is punctured, replace. • Ensure strainer is positioned at bottom of fuel supply |
| 10 | Inspect fuel line hoses and connections for leaks. | <ul style="list-style-type: none"> • Replace hoses if necessary. • Replace or tighten fittings |

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Troubleshooting Checklist

| | | |
|-----------|--|--|
| 11 | Check for fouled spark plug, looking for: <ul style="list-style-type: none"> • Excessive carbon build-up • Cracked insulator • Burned electrodes • Incorrect gap | <ul style="list-style-type: none"> • If excessive carbon build up- clean carbon • If cracked insulator or burnt electrode- replace spark plug • If incorrect gap-gap spark plug using feeler gauge. |
| 12 | Check engine cylinder and head cooling fins for accumulation of foreign matter. | <ul style="list-style-type: none"> • Remove foreign matter |
| 13 | Check for a leaking head gasket | <ul style="list-style-type: none"> • If leaking replace head gasket |
| 14 | Set throttle on carburetor to maximum speed and push lever at speed setting disk toward engine, then release. Lever should snap back quickly and without binding. | <ul style="list-style-type: none"> • If lever snaps back without binding go to step 14 if not continue with step 13. |
| 15 | Remove carburetor and repeat step 12 | <ul style="list-style-type: none"> • If lever snaps back, perform engine speed control system repair. • If lever does not snap back, repair carburetor, checking for broken spring, improper assembly, and other damaged or worn parts. • After repairs have been completed, perform engine speed adjustment procedure. |
| 16 | Perform engine compression test | <ul style="list-style-type: none"> • Repair engine if compression is less than 105 psi. |
| 17 | Inspect clutch for worn bearings, loose or broken clutch springs or worn clutch shoes. | <ul style="list-style-type: none"> • Replace defective components |

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Troubleshooting Checklist

LOW ENGINE POWER OR SPEED

| STEP | TEST OR INSPECTION | CORRECTIVE ACTION |
|------|--|---|
| 1 | Check Throttle setting | <ul style="list-style-type: none"> Set engine throttle to MAX. (During normal operation, throttle should be set to maximum.) |
| 2 | Check carburetor choke position | <ul style="list-style-type: none"> Set choke to open position (During normal operation choke should be set to open position) |
| 3 | Check for contaminated (water) fuel | <ul style="list-style-type: none"> Drain fuel system and fill with fresh engine fuel mixture |
| 4 | Check for clogged air filter | <ul style="list-style-type: none"> If clogged replace |
| 5 | Check for presence of 2-cycle oil in engine fuel mixture | <ul style="list-style-type: none"> If no presence of 2-cycle oil, drain and replace with appropriate mixture. |
| 6 | Check for leaking head gasket | <ul style="list-style-type: none"> Replace head gasket |

ENGINE BACKFIRES

| STEP | TEST OR INSPECTION | CORRECTIVE ACTION |
|------|--|---|
| 1 | Inspect engine fuel filter for signs of water. (Water will look like bubbles or a separate layer of liquid below the fuel) | <ul style="list-style-type: none"> Drain fuel system and fill with fresh engine fuel mixture |
| 2 | Check for fouled spark plug, looking for: <ul style="list-style-type: none"> Excessive carbon build-up Cracked insulator Burned electrodes Incorrect gap | <ul style="list-style-type: none"> If excessive carbon build up- clean carbon If cracked insulator or burnt electrode- replace spark plug If incorrect gap- gap spark plug using feeler gauge. |

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Troubleshooting Checklist

LOW OR NO WATER PRESSURE (LOW OR NO WATER FLOW)

| STEP | TEST OR INSPECTION | CORRECTIVE ACTION |
|------|--|--|
| 1 | Verify that engine throttle is set to MAX | <ul style="list-style-type: none"> Set engine throttle to MAX |
| 2 | Verify that suction hose strainer is completely submerged in water source. <ul style="list-style-type: none"> Strainer must not rest on bottom of natural water source. | <ul style="list-style-type: none"> Reposition hose for use with water tank, deep, or shallow natural water source, as required by your mission. |
| 3 | Check for clogged or improperly installed suction hose strainer | <ul style="list-style-type: none"> If clogged strainer, clean If strainer is backwards, there will be no water flow-reverse strainer |
| 4 | Check for kinks or leaks in suction hose | <ul style="list-style-type: none"> If kinked, straighten suction hose If hose leaks, repair or replace |
| 5 | Check for air leaks on hose coupling connection. | <ul style="list-style-type: none"> Replace coupling gasket |
| 6 | Check for broken/missing or loose water pump belts. | <ul style="list-style-type: none"> Adjust or replace as necessary |
| 7 | Check for contaminants or ice in suction side of pump. | <ul style="list-style-type: none"> Remove contaminants Perform thawing procedures |
| 8 | Check for sheared key on water pump pulley. Note: Key is sheared if pulley turns and pump shaft remains stationary. | <ul style="list-style-type: none"> Replace |
| 9 | Check Valve stuck closed | <ul style="list-style-type: none"> Repair/replace |
| 10 | Check pressure regulating valve | <ul style="list-style-type: none"> Replace |

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Troubleshooting Checklist

ENGINE OVERHEATS

| STEP | TEST OR INSPECTITON | CORRECTIVE ACTION |
|------|---|---|
| 1 | Check for dirt/debris between engine cooling fins and at air intake on starter. | <ul style="list-style-type: none"> Remove dirt and debris |
| 2 | Check for missing fan blades | <ul style="list-style-type: none"> If blades are missing replace fan |
| 3 | Check timing | <ul style="list-style-type: none"> Adjust if necessary |
| 4 | If problems still occur after the first three steps have been accomplished perform engine block cylinder repair procedures. | <ul style="list-style-type: none"> Replace defective components |

WATER COMES OUT PRESSURE RELIEF VALVE

| STEP | TEST OR INSPECTION | CORRECTIVE ACTION |
|------|--|---|
| 1 | Verify that burner extinguishes when both spray wand triggers are released. | <ul style="list-style-type: none"> If burner does not extinguish, perform emergency shutdown. |
| 2 | <ul style="list-style-type: none"> Shut system down Remove and inspect both flow switches' mechanisms for broken spring, dirt, corrosion and freedom of movement. | <ul style="list-style-type: none"> Clean with water Replace if defective |
| 3 | Check for pressure and temperature indications on control panel. Normal operating temperatures and pressures are: WANDS w/injector: 50 deg. C/60-70PSI WANDS w/wands: 117 deg. C/130-150 PSI SHOWERS: 43 deg. C/40-50 PSI | <ul style="list-style-type: none"> If normal pressures and temperatures replace relief valve If temperature is above 130deg. C and pressure is above 230 PSI, replace High Temperature Cut Out Switch. If pressure is above 230 PSI and normal temperature, replace pressure-regulating valve. |

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Troubleshooting Checklist

NO/INCORRECT WATER TEMPERATURE

| STEP | TEST OR INSPECTION | CORRECTIVE ACTION |
|------|--|---|
| 1 | Check the security of the temperature gauge-sensing bulb. | <ul style="list-style-type: none"> Secure sensing bulb |
| 2 | Check setting of Function Selector Switch <ul style="list-style-type: none"> Switch must be set to Showers or Wands | <ul style="list-style-type: none"> Select proper position |
| 3 | Check for burner ignition <ul style="list-style-type: none"> Burner will produce a low rumbling noise if ignited. | <ul style="list-style-type: none"> If not ignited, press center of reset indicator. |
| 4 | Check fuel pressure at control panel. | <ul style="list-style-type: none"> If normal pressure of 95-105 psi is indicated, go to step 7; if pressure is low, proceed with next step. |
| 5 | Remove drive side panel and check for worn or damaged fuel pump belt and belt tensioner. | <ul style="list-style-type: none"> Replace worn or damaged belt Repair/replace tensioner if unserviceable. |
| 6 | Check for return fuel flow by unscrewing burner fuel can cap and lifting hoses up high enough so that return flow from smaller hose is visible and bottom of supply hose is still submerged. | <ul style="list-style-type: none"> If steady, vigorous return flow is noted, replace fuel pressure regulating valve. If steady, vigorous flow is not noted, repair filter. If trouble persists, replace burner fuel pump. |
| 7 | Check if light Emitting Diodes (LEDs) on side of electronic control modules are illuminated. | <ul style="list-style-type: none"> If both LEDs are on in shower mode or with both wand triggers depressed, inspect igniter plug. If only one LED is on in shower mode or with both wand triggers depressed, check and clean upper flow switch. |

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Troubleshooting Checklist

EXCESSIVE NOISE AND VIBRATION

| STEP | TEST OR INSPECTION | CORRECTIVE ACTION |
|------|--|---|
| 1 | Inspect engine mounts for mission hardware and proper adjustment. | <ul style="list-style-type: none"> • Tighten/replace mounting hardware |
| 2 | <ul style="list-style-type: none"> • Check for loose muffler mounting nuts. • Check for damaged muffler | <ul style="list-style-type: none"> • Tighten nuts • Replace muffler |
| 3 | If noise appears to come from the centrifugal fan, remove engine and fan assembly and inspect fan for loose hub, deformed impeller and missing blades. | <ul style="list-style-type: none"> • Repair/replace fan assembly if damaged • If key is sheared, replace key. |
| 4 | Check for worn/defective clutch bearings, worn/damaged clutch housing and/or defective clutch disc. | <ul style="list-style-type: none"> • Replace defective parts |

NO/LOW/FLUCTUATING HEATER FUEL PRESSURE

| STEP | TEST OR INSPECTION | CORRECTIVE ACTION |
|------|--|--|
| 1 | Check for empty heater fuel can | <ul style="list-style-type: none"> • Refill heater fuel can |
| 2 | Check for clogged heater fuel can strainer | <ul style="list-style-type: none"> • Clean strainer screen • Ensure strainer is positioned at bottom of fuel can. |
| 3 | Check heater fuel hoses for cuts, leaks, and loose connections. | <ul style="list-style-type: none"> • Replace fuel lines • Tighten fuel fittings |
| 4 | Check fuel pump drive belts | <ul style="list-style-type: none"> • Adjust/Replace |
| 5 | Check temperature of heater fuel can | <ul style="list-style-type: none"> • If the container feels warm to the touch, (approximately 80deg. F or hotter), switch to an alternate fuel supply (diesel, jet fuel, or kerosene) |
| 6 | Inspect heater fuel filter for signs of water or contaminants. (Water will look like bubbles or a separate layer of liquid below the fuel) | <ul style="list-style-type: none"> • Drain fuel system and fill with fresh engine fuel mixture • Replace filter |

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Troubleshooting Checklist**“RESET” LAMP IS OFF WHEN BURNER FAILS TO IGNITE**

| STEP | TEST OR INSPECTION | CORRECTIVE ACTION |
|------|---|---|
| 1 | Remove switch guard and check for continuity across lamp – contacts X1 to X2 on pushbutton. | <ul style="list-style-type: none"> If open, replace bulb |

UNABLE TO RESET AT “RESET” PUSHBUTTON

| STEP | TEST OR INSPECTION | CORRECTIVE ACTION |
|------|---|---|
| 1 | Check continuity across reset switch (contacts 1 and 2) | <ul style="list-style-type: none"> Replace switch if open. |

BURNER WILL NOT LIGHT

| STEP | TEST OR INSPECTION | CORRECTIVE ACTION |
|------|--|--|
| 1 | Check temperature of water supply. | <ul style="list-style-type: none"> If water supply temperature is above 32deg C (90deg F), burner will not light when function switch is set to showers. |
| 2 | Check for empty heater fuel can | <ul style="list-style-type: none"> Refill fuel can |
| 3 | Verify that engine throttle is set to MAX | <ul style="list-style-type: none"> Set to MAX |
| 4 | Ensure position of selector switch isn't off. | <ul style="list-style-type: none"> Set to appropriate position needed |
| 5 | Verify that fuel pressure gauge indicates 95 to 105 PSI. | <ul style="list-style-type: none"> If no fuel pressure is indicated, go to step 11. If fuel pressure fluctuates, go to step 12. If fuel pressure is significantly below normal pressure, replace filter. After replacement of fuel filter and pressure remains low, replace fuel pump. |
| 6 | Check water pressure gauge. <ul style="list-style-type: none"> Burner may not light if water pressure is less than 40PSI. | <ul style="list-style-type: none"> If less than 40 go to step 7 |

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BURNER WILL NOT LIGHT

| | | |
|-----------|--|--|
| 7 | Check reset indicator light | <ul style="list-style-type: none"> • Press to reset ignition system |
| 8 | Check burner fuel valve setting | <ul style="list-style-type: none"> • Turn fully clockwise |
| 9 | Inspect heater fuel filter for signs of water or contaminates. (Water will look like bubbles or a separate layer of liquid below the fuel) | <ul style="list-style-type: none"> • Drain fuel system and fill with fresh engine fuel mixture • Replace filter |
| 10 | Check for correct type heater fuel | <ul style="list-style-type: none"> • If this is the first start of your mission and you are using diesel fuel in the heater fuel can, touch the can. If it's cool to the touch 60deg.F or colder, replace diesel fuel with MOGAS. |
| 11 | With unit shut down, check the connections on the high voltage tripler. | <ul style="list-style-type: none"> • Tighten |
| 12 | With unit shut down, verify cap is tight on fuel igniter plug. | <ul style="list-style-type: none"> • Tighten |
| 13 | With unit shut down, check fuel igniter for: <ul style="list-style-type: none"> • Carbon deposits • Cracked insulator • Wet fuel deposits | <ul style="list-style-type: none"> • Clean carbon deposits off • Replace fuel igniter if insulator is cracked. • If wet with fuel, clean with rag and wait a few minutes-allowing excessive fuel to dry. |
| 14 | With unit shut down, check mica window for cracks and build up of soot. | <ul style="list-style-type: none"> • Clean/Replace |
| 15 | Check for spark at igniter plug | <ul style="list-style-type: none"> • Replace if necessary. |
| 16 | Check photocell resistance | <ul style="list-style-type: none"> • Replace if Photocell fails test. |
| 17 | With engine at full MAX and function switch in WANDS or SHOWERS, test voltage input to igniter assembly at TB2-1 (ground) and TB2-3. | <ul style="list-style-type: none"> • If negative 6.5 VDC (minimum) is not measured, replace igniter assembly |
| 18 | Check AC input voltage to electronic control module at TB2-1 (ground) and TB2-2. | <ul style="list-style-type: none"> • If 10 VAC (minimum) is not measured, replace electronic control module. |
| 19 | Check for electrical output from the engine power-generating coil. | <ul style="list-style-type: none"> • If 10 VAC (minimum) is not measured at maximum engine throttle, replace power-generating coil. |

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BURNER WILL NOT LIGHT

| | | |
|-----------|--|---|
| 20 | Disconnect junction box wiring harness assembly from control module in junction box and check for loose or improperly attached connectors and continuity. | <ul style="list-style-type: none"> • If continuity is not measured in all tests, tighten attached crews and/or crimp-on terminals as necessary. • If trouble persists replace wiring harness. |
| 21 | Check for loose or improperly attached connectors and measure continuity of system wiring harness. | <ul style="list-style-type: none"> • If continuity is not measured in all tests, tighten attaching screws and/or terminals as necessary. • Replace system-wiring harness if lack of continuity continues. |
| 22 | Check flow switch FS1 | <ul style="list-style-type: none"> • Replace flow switch if defective. |
| 23 | Disconnect jumper wire 12 from TB3-12; turn function selector switch to wands and measure continuity between TB2-3 to TB2-4, and TB3-12 to TB1-12. Reinstall jumper when check is completed. | <ul style="list-style-type: none"> • If continuity is not measured, repair, replace or tighten jumper wires 14 and 16. • Replace function selector switch if lack of continuity continues. |
| 24 | Check fuel valve assembly by temporarily disconnecting lead 28 from TB1-5 and measuring for continuity between TB1-3 and disconnected wire lead. | <ul style="list-style-type: none"> • Replace fuel valve assembly if open. (Normal resistance is approximately 5 ohms) |
| 25 | With system operating in wands, check for DC voltage between TB1-12 and TB2-1 (ground). | <ul style="list-style-type: none"> • Replace control module if minimum of 35 VDC is not measured. |
| 26 | With system operating in wands, check high temperature cutout (HTCO) switch by measuring for DC voltage at TB3-10 with ground at TB3-1. | <ul style="list-style-type: none"> • If a minimum of 35 VDC is not measured replace HTCO switch. |
| 27 | With system operating in wands, and wands connected, check low-pressure cutout (LPCO) switch by measuring DC voltage at TB3-8, with ground at TB3-1. | <ul style="list-style-type: none"> • Replace manometer assembly if minimum of 35 VDC is not measured. |
| 28 | With system operating in wands, and wands connected, check high-pressure cutout (HPCO) switch by measuring DC voltage at TB3-8, with ground at TB3-1. | <ul style="list-style-type: none"> • Replace manometer assembly if minimum of 35 VDC is not measured. |
| 29 | Recheck all wiring using the system schematic and wiring diagram. | <ul style="list-style-type: none"> • Replace control module if trouble persists. |

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Troubleshooting Checklist

NORMAL WATER PRESSURE WITH LOW/NO WATER FLOW

| STEP | TEST OR INSPECTION | CORRECTIVE ACTION |
|------|---|---|
| 1 | Check for clogged branch hose strainer | <ul style="list-style-type: none"> • Clean branch hose strainer |
| 2 | If operating in freezing weather conditions, check for frozen pressure hoses and accessories. | <ul style="list-style-type: none"> • Perform thawing procedures. |

NO/LOW WATER FLOW FROM ONE SPRAY WAND

| STEP | TEST OR INSPECTION | CORRECTIVE ACTION |
|------|--|---|
| 1 | Check end of spray wand nozzle for blockage. | <ul style="list-style-type: none"> • Rotate spray wand nozzle fully clockwise. Clean nozzle using 2-inch diameter brush. |

BURNER CYCLES EXCESSIVELY

| STEP | TEST OR INSPECTION | CORRECTIVE ACTION |
|------|---|--|
| 1 | Check for inoperable manual fuel control valve (valve is inoperable if burn rate cannot be controlled.) | <ul style="list-style-type: none"> • Replace manual fuel valve assembly. • If trouble persists, replace one or both fuel check valves. |

TEMPERATURE TOO HIGH (SHOWER MODE)

| STEP | TEST OR INSPECTION | CORRECTIVE ACTION |
|------|--------------------|---|
| 1 | | <ul style="list-style-type: none"> • Replace LTCO switch if this condition exists. |

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Troubleshooting Checklist**BURNER CONTINUES TO OPERATE**

| STEP | TEST OR INSPECTION | CORRECTIVE ACTION |
|-------------|--|--|
| 1 | With system operating, close manual fuel valve assembly fully clockwise. | <ul style="list-style-type: none">• If burner continues to operate, replace fuel control valve.• If burner goes out, replace one or both fuel check valves. |

NO HEATING (SHOWERS ONLY)

| STEP | TEST OR INSPECTION | CORRECTIVE ACTION |
|-------------|--|---|
| 1 | Check the function selector switch for continuity between switch contacts. (Be sure system is shut down and function selector is in the off position). | <ul style="list-style-type: none">• Replace the function selector switch if continuity is not measured across each switch segment, SW1A1, SW1A2, and SW1A3. |

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Review Questions for Troubleshoot

| Question | Answer |
|---|--|
| 1. What position must the throttle be in prior to starting the engine? | a. $\frac{1}{4}$ b. $\frac{1}{3}$ c. $\frac{1}{2}$ d. $\frac{3}{4}$ |
| 2. What must be done to the carburetor on the first start of the day or a cold engine? | a. Prime the carburetor b. Check the fuel can c. Check fuel filter for contaminates d. Set throttle at $\frac{1}{4}$ position |
| 3. Bubbles or a separate layer of liquid below the fuel will indicate water in a fuel filter. | a. True b. False |
| 4. What outside air temperature can contribute to a fuel system vapor lock? | a. 70 deg. F b. 75 deg. F c. 80 deg. F d. 85 deg. F |
| 5. Of the following problems, which is not contributed by a fouled spark plug? | a. Engine runs erratic. b. Engine will not start c. Engine back fires d. Low engine speed |
| 6. What is the minimum compression of an engine before it needs repairing? | a. 95 psi b. 100 psi c. 105 psi d. 110 psi |
| 7. What position should the engine throttle be set at when in normal operation? | a. $\frac{1}{3}$ position b. $\frac{1}{2}$ position c. $\frac{3}{4}$ position d. Full position |
| 8. Other than a loose or broken belt on the water pump, what would also cause low or no water pressure? | a. Sheared key on pulley. b. Check valve stuck closed c. Defective pressure regulating valve |

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| Question | Answer |
|----------|----------------------|
| | d. All of the above. |

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Review Questions for Troubleshoot

| | |
|---|--|
| 9. Timing out of adjustment will cause the engine to overheat | a. True b. False |
| 10. A shorted condenser in your points will cause what problem? | a. Unit to run Erratically b. Fail to operate c. Backfire d. Low engine speed |
| 11. If temperature is above 130deg. C and pressure is above 230 PSI, which component should you replace? | a. High Pressure Cut Out b. High Temperature Cut Out c. Pressure relief valve d. None, normal pressure and temperature. |
| 12. If your burner fails to shut down and you manually close the fuel valve assembly, where is your problem? | a. Fuel Check valve b. Fuel pump c. Fuel burner d. Fuel Control valve |
| 13. What is your minimum water pressure before the burner will not ignite? | a. 40 PSI b. 45 PSI c. 50 PSI d. 55 PSI |
| 14. What is considered as an alternative fuel source? | a. Unleaded gas b. Kerosene c. Diesel d. Both A & B e. Both B & C f. All of the above |
| 15. If the water supply temperature is above 32deg C (90deg F), what position of the function switch will the burner not light? | a. Showers b. Wands c. Both d. Neither |

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**Review Questions
for
Troubleshoot**

| | |
|---|--|
| 16. At what temperature should you replace diesel with MOGAS? | a. 60 deg. F b. 70 deg. F c. 80 deg. F d. 90 deg. F |
| 17. What should you look for when you inspect the mica window? | a. Cracks b. Soot build up c. Both A & B |
| 18. What is the minimum voltage measured on an igniter assembly before you replace it? | a. Positive 6.5 VDC b. Negative 6.5 VDC c. Positive 6.5 VAC d. Negative 6.5 VAC |
| 19. What must you replace when you read 25 VDC, when checking your high-pressure cutout (HPCO) switch between TB3-8 with ground at TB3-1, with the system operating in wands and wands connected. | a. HPCO b. LPCO c. HTCO d. Manometer assembly |
| 20. What must you replace when checking the electrical output from the engine power-generating coil and you read 5 VAC with the engine throttle at max? | a. Power-generating coil b. Electronic control module c. Both d. Neither |

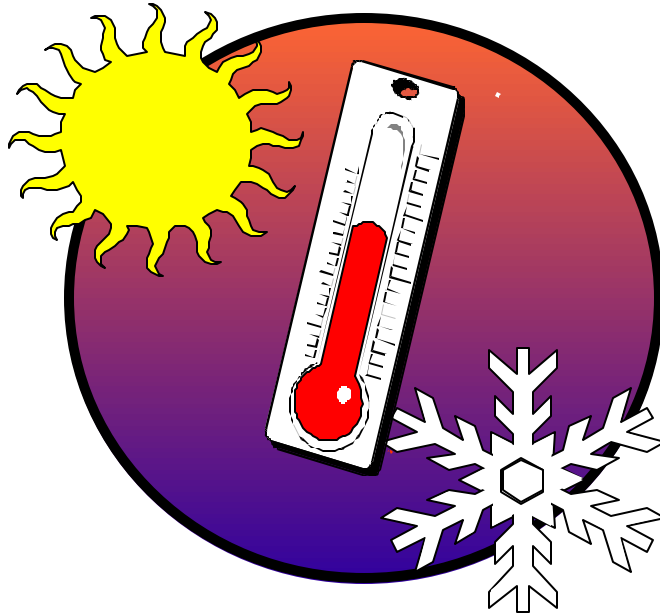
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TROUBLESHOOT

| Performance Checklist | | |
|------------------------------|-----|----|
| Step | Yes | No |
| 1. Engine | | |
| 2. Engine fuel system | | |
| 3. Electronic control system | | |
| 4. Air system | | |
| 5. Heater system | | |
| 6. Heater fuel system | | |
| 7. Water system | | |

FEEDBACK: Trainer should provide both positive and/or negative feedback to the trainee immediately after the task is performed. This will ensure the issue is still fresh in the mind of both the trainee and trainer.

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LIGHTWEIGHT DECONTAMINATION UNIT

MODULE 27

AFQTP UNIT 3

REPAIRS

(27.3.1..)

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REPAIRS

Task Training Guide

| | |
|---|--|
| STS Reference Number/Title: | 27.3.1. Repairs |
| Training References: | <ul style="list-style-type: none"> • TO 11D1-3-9-1 • TO 11D1-3-9-2 |
| Prerequisites: | <ul style="list-style-type: none"> • Possess as a minimum a, 3E131 AFSC |
| Equipment/Tools Required: | <ul style="list-style-type: none"> • Personal Protective Equipment/Clothing • Standard Tool Bag • Torque Wrench • Crankshaft Retaining Tool • Spark Plug Feeler Gauge • Point's Feeler Gauge • Timing Gauge • Cylinder Compression Tester • Wheel Puller • Rubber Mallet • Cheese Cloth |
| Learning Objective: | <ul style="list-style-type: none"> • Trainee will know the steps to safely repair malfunctions on the Lightweight Decontaminating Unit (LDU). |
| Samples of Behavior: | <ul style="list-style-type: none"> • Trainee will be able to repair malfunctions on the LDU. |
| Notes: | |
| <ul style="list-style-type: none"> • To successfully complete this element, the steps must be followed exactly. • Any safety violation is an automatic failure. | |

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REPAIRS

Background: This section covers the repair procedures of the Lightweight Decontamination Unit. It would not be practical to cover all repairs that you may come across on the LDU. So, only repairs needed to cover the test/inspection and corrective action that was covered in the troubleshooting section are listed here. If any repairs or test procedures are needed for items that are not covered in this section, consult the appropriate Technical Order or contact your supervisor.

Before you start any repairs ensure you read, understand, and comply with all safety warnings that are listed. Failure to comply with these safety warnings could contribute to equipment or personnel injury. Also, if applicable, make sure the appropriate Personnel Protective Equipment (PPE) is worn.

SAFETY:

TO PREVENT INJURY TO PERSONNEL AND DAMAGE TO THE EQUIPMENT, DO NOT ALLOW FUEL TO DRIP ONTO HOT ENGINE OR BURNER COMPONENTS. MAKE SURE A FIRE EXTINGUISHER IS READILY AVAILABLE.

To perform the task, follow these steps:

- After you inspected the fuel filter and found water or other contaminants, drain the engine fuel system as follows:

Step 1: Drain a contaminated engine fuel system.

- Remove engine fuel can lid assembly from fuel can. Place fuel hose strainer in any available container.
- Lower container and fuel hose to ground level.
- Squeeze ball pump and allow fuel to drain into container.
- Dispose of contaminated fuel found in fuel can in accordance with local Standard Operating Procedure (SOP).
- Refill engine fuel can with fresh engine fuel mixture.
- Reinstall engine fuel can lid assembly in fuel can.
- Using 10-mm wrench, loosen carburetor main jet (about two turns) until fuel drains from carburetor bowl. Allow contents to drain. If required, push bowl up toward carburetor body and off of main jet seat to obtain enough clearance for fuel to drain.

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- Squeeze ball pump to purge contaminated fuel from system.
- After draining, screw main jet back into carburetor bowl using the 10-mm wrench. Turn jet several times until snug, but do not over tighten.

Step 2: Un-vapor lock the engine fuel system.

- If unit is being operated in hot weather (above 80deg. F), and the engine fuel filter is only partially full or contains large bubbles, vapor lock has occurred. Perform the following steps to UN-vapor lock the fuel system.
- Move unit out of direct sunlight and cool engine fuel tank with a wet rag.
- Squeeze fuel line ball pump to release trapped air bubbles.
- Attempt to restart engine.

Note:

If replacing a spark plug, always check the new plug gap for the appropriate clearance. Never assume it is factory set to the right clearance.

Step 3: Adjusting spark plug gap.

- Remove the spark plug cap by holding firmly onto the cap. Never attempt removing the spark plug cap by pulling the wire, as this could cause the wire to separate from the cap.
- Remove spark plug with deep socket wrench.
- Inspect plug for cracks, dirt, and burned electrodes.
- If plug appears dirty, but otherwise intact, clean with rag or abrasive paper.
- If unserviceable replace with new plug.
- Check gap, by using a feeler gauge.
- Gap clearance should be 0.20 – 0.035 in (0.51 – 0.89 mm).
- Replace spark plug using deep socket wrench.
- Replace plug cap.

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Step 4: Checking adequacy of spark on spark plug.

SAFETY:

WHEN CHECKING SPARK PLUGS FOR ADEQUACY OF SPARK BE SURE NOT TO TOUCH PLUG OR CAP WITH YOUR BARE HAND. FAILURE TO HEED THIS WARNING MAY RESULT IN INJURY FROM ELECTRIC SHOCK.

- After you have removed spark plug, reconnect spark plug cap onto plug.
- Press threaded portion of plug to a good engine ground.
- Pull starter handle.
- Spark should be plainly visible and blue in color.
- Reinstall spark plug.

Step 5: Power generating coil and ignition system repairs.

NOTE:

Ignition system repairs may be performed with engine removed or in place.

- Disassembly (Figure 1)
- Remove starter if installed.
- Remove four small bolts and two large bolts along with hardware, (1,2).
- Remove ring (16), three nuts (15), washers (14), carrier (13) and gasket (12).

NOTE:

Hole pattern is such that crankshaft retaining tool goes on only one way, do not force..

- Install crankshaft-retaining tool, on fan (9) to keep shaft from turning. Retainer fits on the three bolts protruding from fan. Use nuts (15) to secure in place.
- Remove nut (11) and lock washer (10), then remove crankshaft retaining tool.
- Install flywheel puller on fan (9) as follows
- Screw extender nuts on three protruding bolts (6).

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- Position puller plate on extender nuts and secure with bolts, provided with puller, finger tight.
- Tighten large center bolt on puller until flywheel breaks loose.
- Remove fan and flywheel (8) as a unit, then remove key (23).
- Remove three bolts (6) and washers (7) to separate fan (9) from flywheel (8).
- Loosen two screws (5), and washers (4), attached to cap (3) and remove cap.
- Remove terminal nut and disconnect wires from condenser (18).

NOTE:

Condenser will be damaged if removed. Do not remove unless defective.

- If condenser removal is required, remove condenser (18), using a pair of pliers.
- Remove screw (20), two washers (21), and ignition points (19).
- Remove two screws (24) and washers (25); cut yellow coil wire close to grommet in side of engine and remove coil (26).
- Remove two screws (27), washers (28), and coil (29) from plate (33).
- Unscrew spark plug wire (22) from coil (29), holding wire stationary and twisting coil CCW to remove coil.

NOTE:

Removal of plate (33) will require timing of engine at reinstallation. Remove only if necessary.

- Remove two screws (30), washers (32), lock washers (31), and plate (33).
- Remove ring (34), washer (35) and felt (36).

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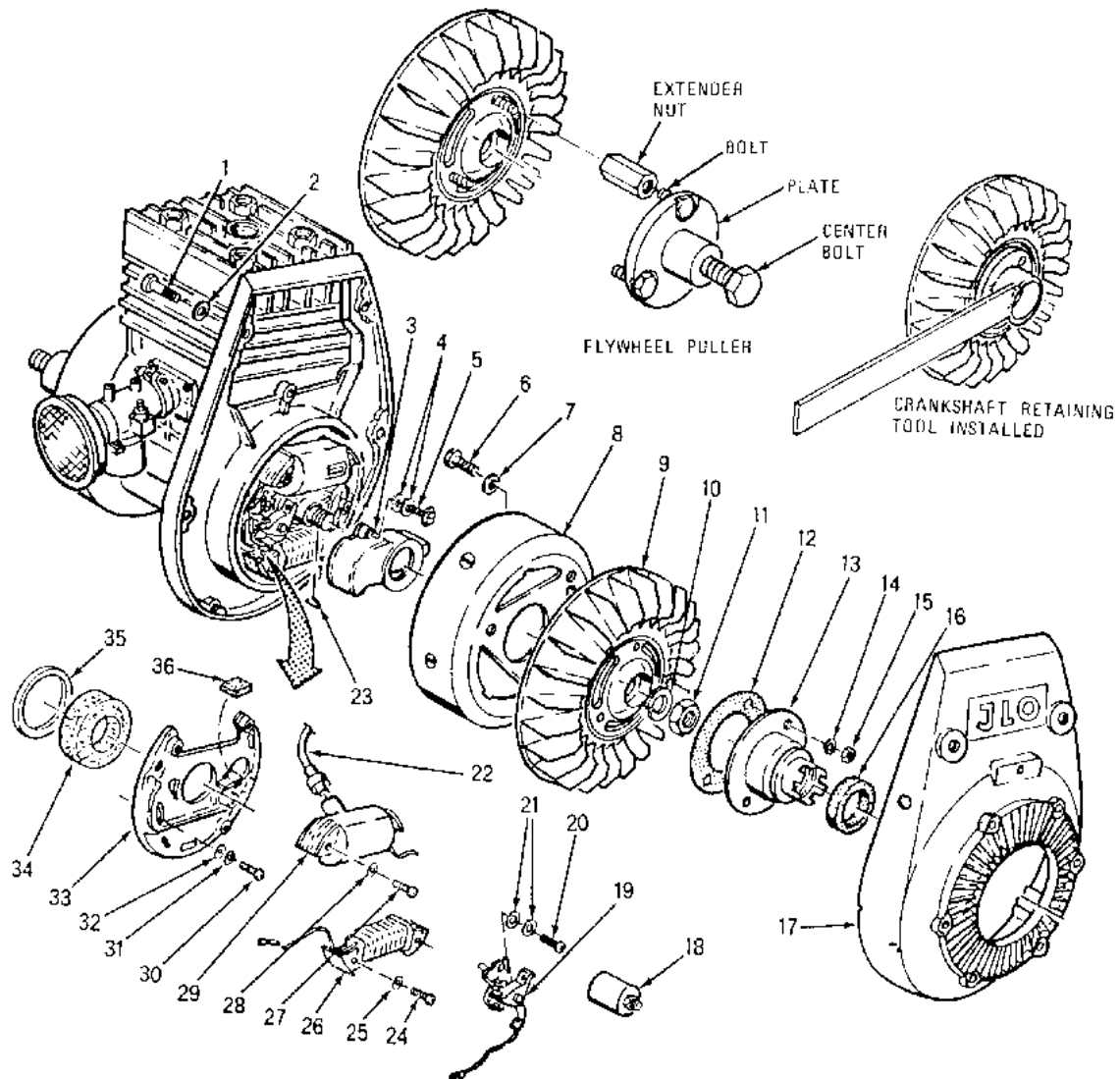


Figure 1, LDU

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- Clean and inspect.
- Clean all parts and mounting surfaces with cleaning solvent and allow to dry.
- Inspect mounting hardware for rust/corrosion and stripped threads.
- Inspect all parts for general condition and wear.
- Inspect carrier for cracks, dents or wear. Carrier may wear at points of engagement with starter pawl.
- Inspect fan for broken/chipped blades and worn keyways.
- Inspect coil for continuity between primary winding terminal and ground then between high voltage terminal and ground. Reject if resistance is significantly above or below 0.5 ohms between primary winding terminal and ground and 5 kilo-ohms between high voltage terminal and ground. (Figure 1)
- Check condenser for short to ground. Reading must be infinity. Replace condenser, if reading is low or pitting and excessive transfer of metal is noted on ignition point contacts. (Figure 2)
- Check power-generating coil for continuity between output lead to TB2-2 and ground, it should read approximately 0.5 ohms. Lead must be disconnected. Reject if reading is significantly above or below 0.5 ohms. (Figure 2)
- Inspect ignition points for burned or pitted contacts.

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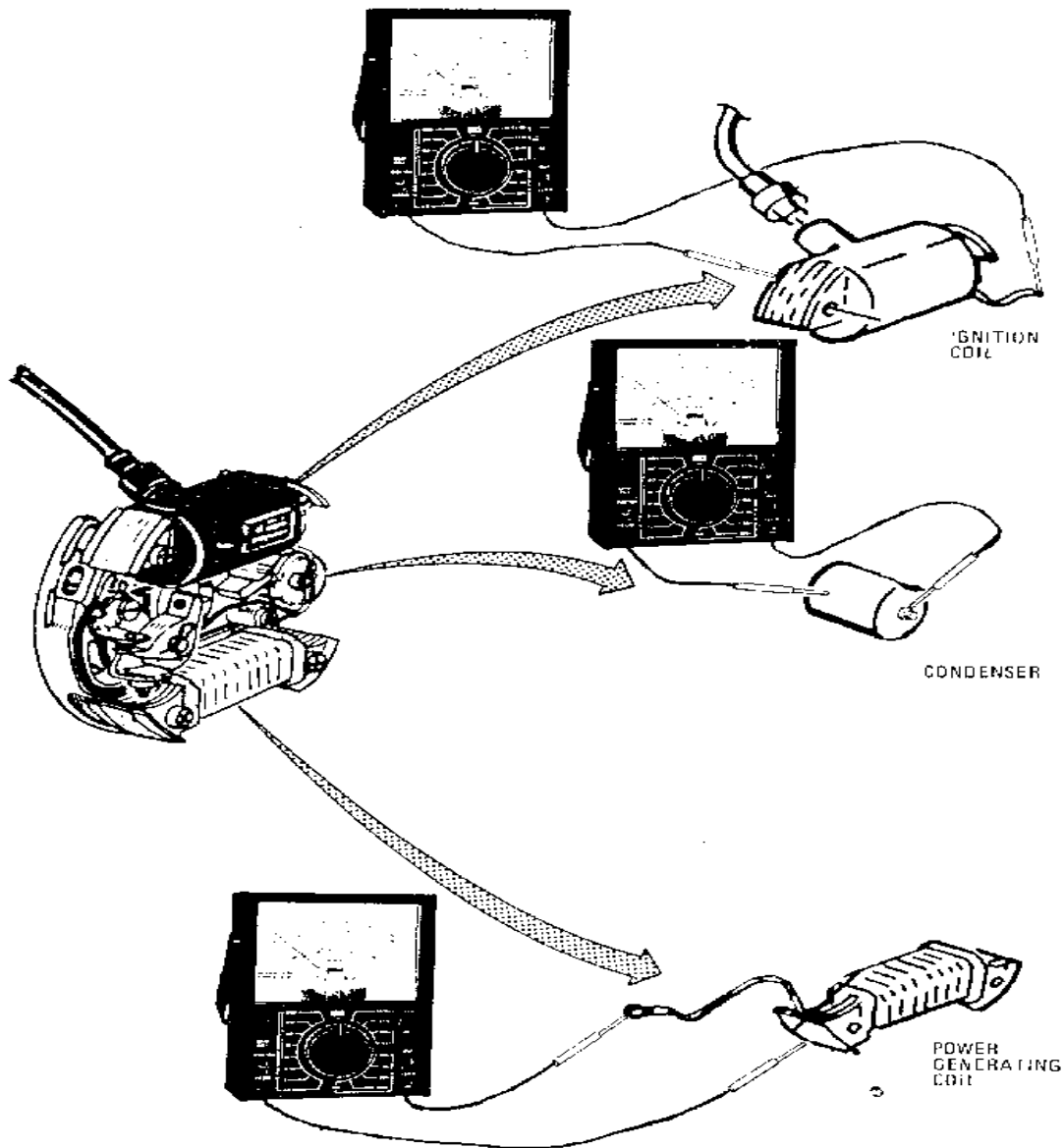


Figure 2, Power Generating Coil and Condenser

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- Assembly (Figure 3).
- Position felt washer (19) and ring (18) on engine shaft and install armature plate (17) with two washers (16), lock washers (15) and screws (14), finger tight.
- Install felt (1).
- Screw spark plug wire (2) into ignition coil receptacle by holding wire stationary and twisting coil CW until secure. Position sleeve on plug wire and coil connector.
- Install ignition coil (13) on mounting plate (17) with two screws (11) and washers (12). Adjust plug wire as necessary to reduce slack inside of engine.
- Install condenser (7). Condenser installation requires a socket, approximately equal in outer diameter as outer diameter of condenser. Position condenser on mounting hole (contact point up); position socket on top of condenser and tap lightly with a hammer until securely in place.
- Install power generating coil (10) as follows:
 - Thread yellow output wire through cutout in plate (17) and pushes through grommet in the side of engine.
 - Secure coil to armature plate (17) with two screws (8) and washers (9).
 - If cut, connect wire to output wire, cut at disassembly, with a butt splice.
- Apply a small amount of grease provided with ignition points to felt (1) and install contact points (6), finger tight on plate (17) with screw (5) and washers (4).
- Position terminals of lead from coil (13), contact points (6) and black wire (3) going to emergency shutdown switch on condenser stud and secure with nut and washer (integral components of condenser).
- Check/gap contact points and if required, check/adjust engine timing.
- When correct gapping and timing is achieved adjust wiring on armature plate for neatness and orderliness (Plate provides a groove for contact point wire.) and install cover (3) with two screws (5) and washers (4).
- Secure flywheel (8) to engine fan (9) with three bolts (6), and washers (7). Watch out for hole pattern, it goes on only one way. Do not install nuts (15) at this time.

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NOTE:

Fan has two keyways. Failure to properly position fan will result in inability to start engine. When crankshaft keyway is at 12 o'clock, flywheel must be positioned with one keyway at 3 o'clock and the

- Install key (18) on engine shaft.
- Position fan (9) and flywheel (8) on shaft as an assembly.
- Position lockwasher (10) on engine shaft and install nut (11) finger tight.
- Obtain crankshaft retaining tool and install on bolts, protruding from fan assembly with three nuts (15) – it only fits one way, do not attempt to force.
- Obtain torque wrench, and torque nut (11) to 32.5-ft. lb. While holding shaft with retaining tool.
- Remove retaining tool and install gasket (12) and carrier (13). Secure with nuts (15) and washers (14).
- Install ring (16) and fan cover (17) with two large bolts (1) and washers (2) on center of each side and four small bolts (1) and washers (2) at top and bottom on each side.
- Install spark plug and reconnect cap (attached to spark plug wire) to plug.
- Install starter.

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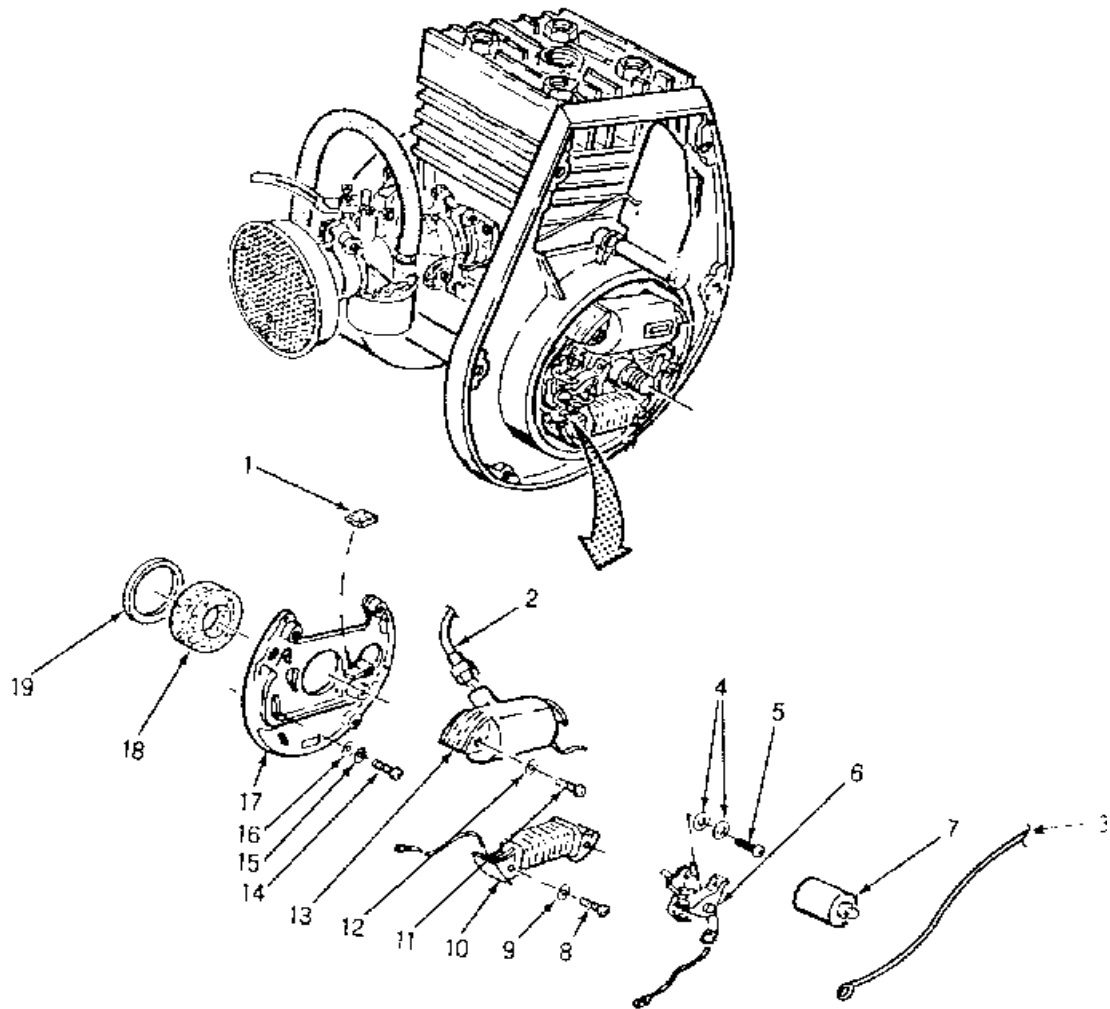


Figure 3, LDU Engine

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NOTE:

Tool is necessary to keep engine from turning while torquing nut (11).

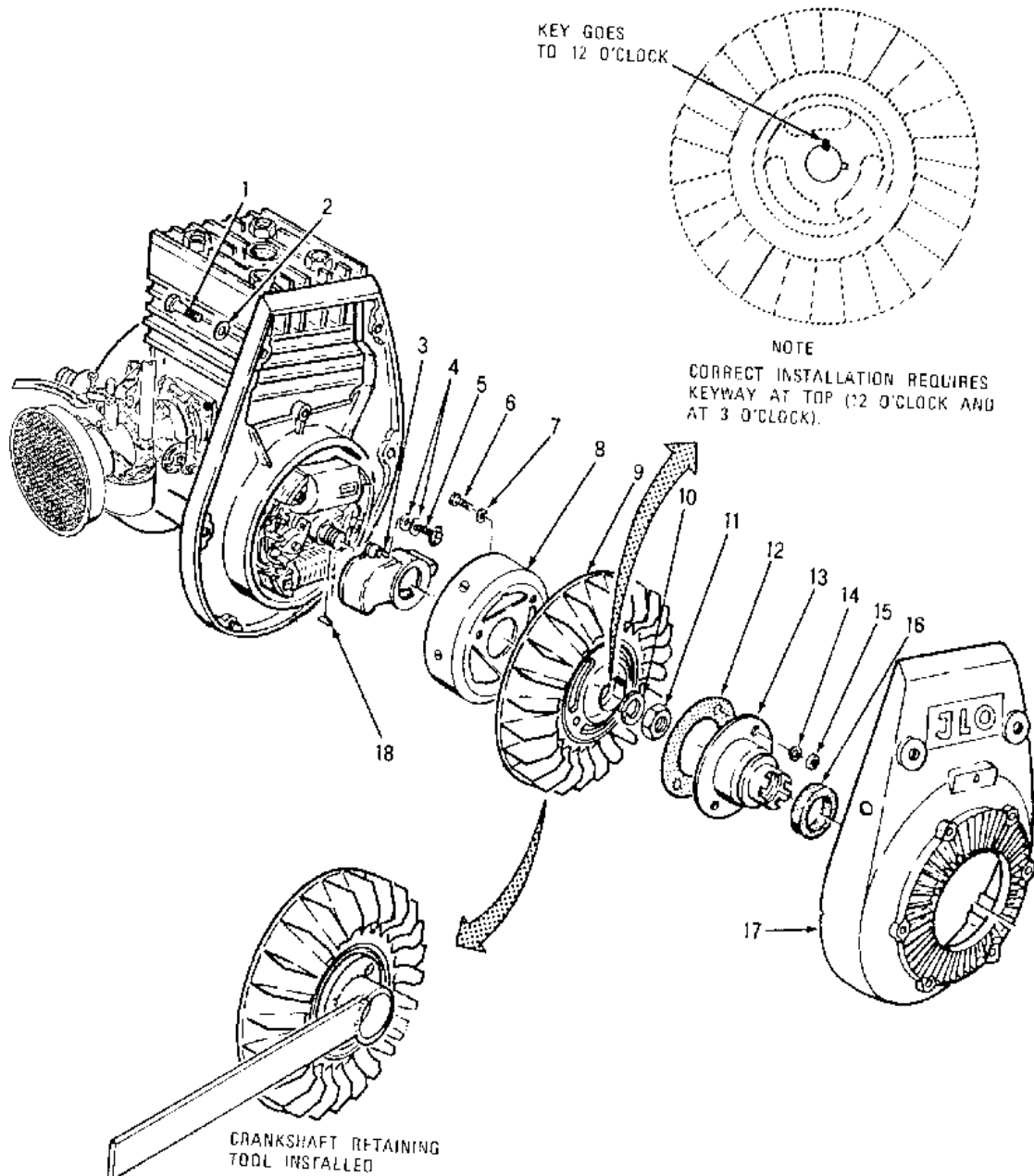


Figure 4, LDU

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Step 6: Ignition points check and adjustment. (Figure 5)

- As necessary perform disassembly procedure in previous section (Power generating coil and ignition system repairs), steps 1-9.
- Turn engine shaft until ignition points are open to the widest gap (piston at Top Dead Center TDC).
- Check points (2) for burned or pitted contacts, freedom of movement, loose or frayed wire. Replace as necessary.
- Using a feeler gauge, check point gap.
- If 0.012 to 0.015 inches are measured, adjustment is correct; reassemble engine.
- If gap is less or greater than 0.012 to 0.015, adjust points as follows:
- Insert a medium flat tip screwdriver between point adjustment slot and adjustment pivot.
- Slightly loosen screw (1).
- With screw (1) loose, twist screwdriver and note that points open or close in response to twist.
- When gap is within range of 0.012 to 0.015 inches, tighten screw (1).
- As required, perform timing adjustment procedure or reassemble engine.

NOTE:

Timing should be required only if armature plate was disturbed or timing was previously out of adjustment.

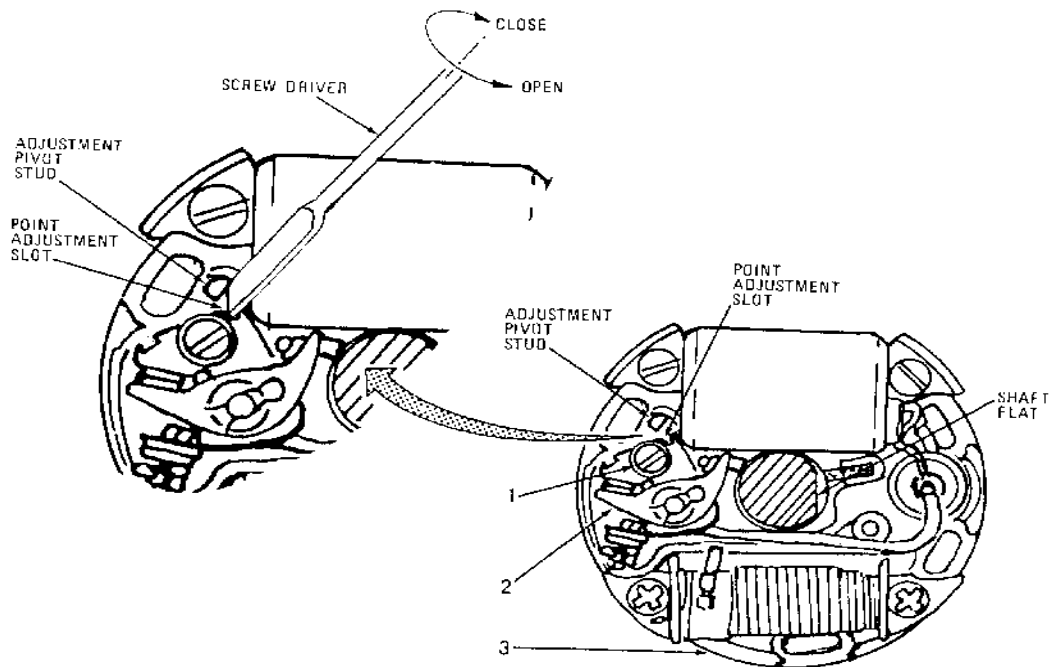


Figure 5, LDU Engine Timing

Step 7: Engine timing check/adjustment. (Figure 6)

- As necessary perform engine ignition components disassembly procedure in previous repair (Ignition Points Check and Adjustment), steps 1 through 9.
- Check, and if required, gap points.
- If points are serviceable and correctly gapped, assemble timing gauge and install timing gauge in spark plug hole finger tight.
- Slowly turn engine shaft CW until engine piston is at TDC. TDC is reached when dial indicator needle reverses direction.

NOTE:

Engine timing diagram explains the relationship between piston position and positioning of contact points.

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- Loosen adjustment setscrew/collar on side of timing gauge and pull gauge in or out until a reading of 4 mm is achieved on coarse scale of timing gauge, then tighten, setscrew collar.
- Continue adjustment of timing gauge, adjusting longer needle to zero by turning outer adjustment ring.
- When timing gauge is adjusted for exactly 4.00 mm, turn crankshaft one revolution (always turn CW) until contact points just begin to open – for accurate reading point opening should be checked with multimeter, touched to contact point lead, which is temporarily disconnected from condenser. Touch ground lead to plate (2).
- Note timing gauge reading at point opening. If points open between 1.44 mm to 1.8 mm on timing gauge (indicating piston position between 2.2 to 2.6 mm Below Top Dead Center, BTDC) timing is correct, reassemble engine according to steps 10 – 20 in previous section, (Ignition Points Check and Adjustment).
- If points do not open timing gauge reading of 1.4 mm to 1.8 mm, adjustment is necessary.
- Loosen two screws (1) and adjust armature plate (2) so that elongated mounting holes are approximately centered on screws (1). Tighten screws finger tight.
- Turn crankshaft CW until timing gauge indicates 1.5 mm. This corresponds to piston position of 2.5 mm BTDC.
- While touching multimeter leads to ignition points lead and plate (2) loosen screws (1) and slightly turn plate CW or CCW as required until points just open. Tighten screws (1).
- Attach ignition points lead to condenser and reassemble engine according to steps 10 – 20 in previous section, (Ignition Points Check and Adjustment).

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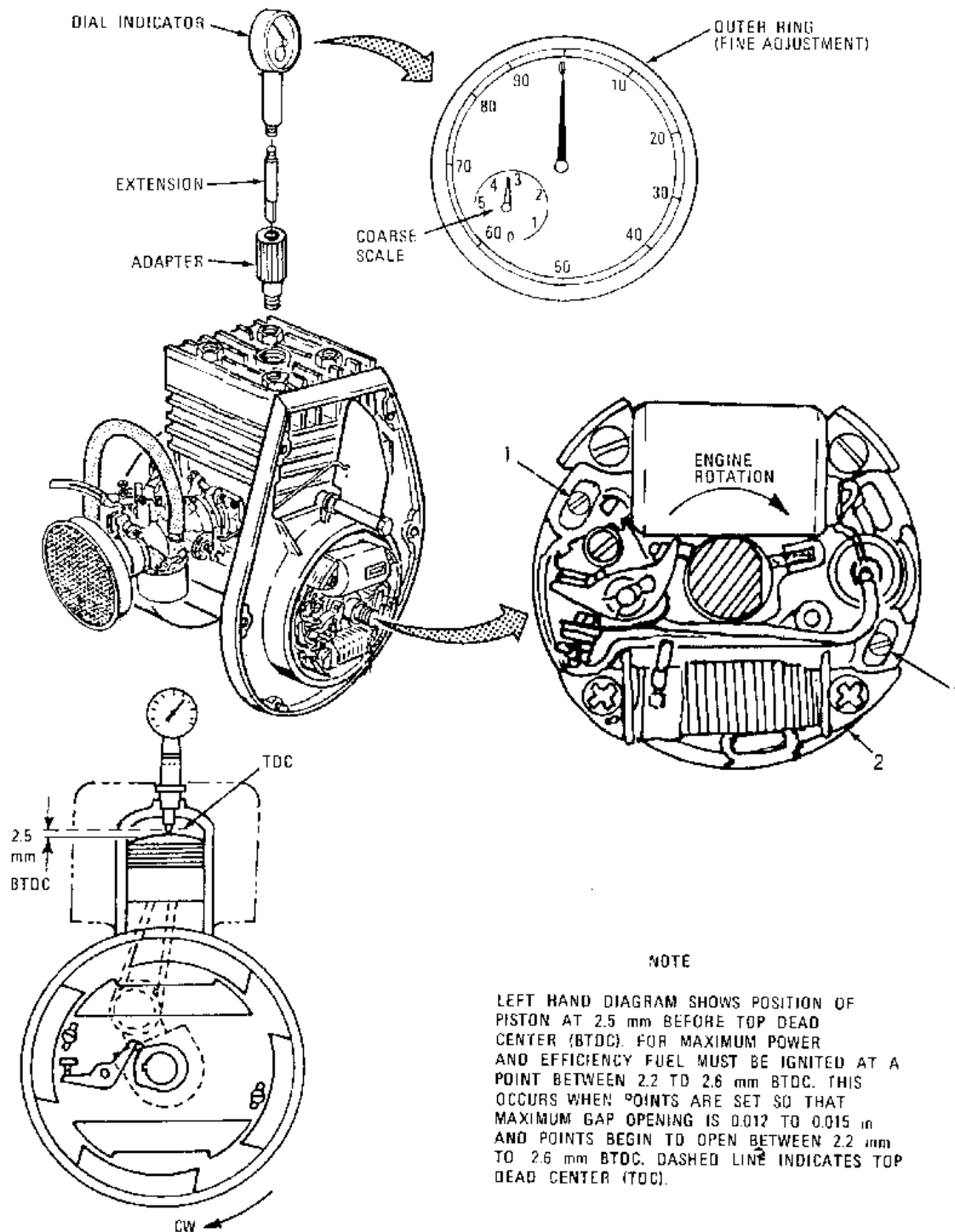


Figure 6, Engine Timing Check/Adjustment

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Step 8: Replacement of cylinder head and gasket. (Figure 8)

- Disconnect cap (1) from spark plug.
- Remove spark plug (2).
- Remove four nuts (3) and washers (16).
- Mark position of head in relation to cylinder to ease installation.

NOTE:

A slight tap with a mallet may be necessary to loosen the head. Be careful not to damage fins.

- Prior to removing the cylinder head (17), inscribe a mark to note which side is facing carburetor.
- Remove cylinder head gasket (18).
- Remove as much carbon as possible by scraping with a putty knife and using cleaning solvent, clean mating surfaces of cylinder and cylinder head and wipe off with rags.
- Place replacement gasket (18) on cylinder with wider metal ring facing up.
- Reinstall head (17) as marked with four nuts (3) and washers (16), finger tight until snug.
- Using torque wrench, cross torque nuts (3), first to 10 – 12 ft lb., in sequence described in diagram.
- Repeat step 10 with 28 – 32 ft lb. of torque.
- Reinstall spark plug and connect cap.

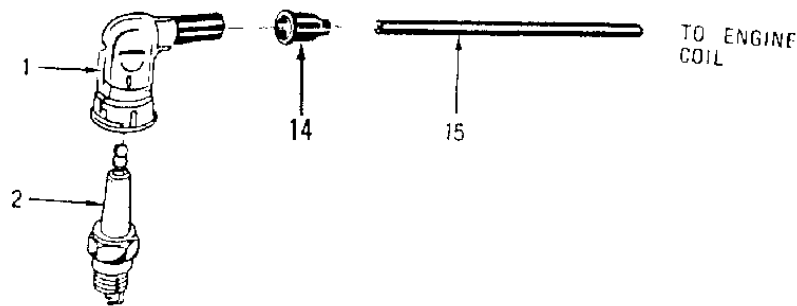


Figure 7, Replacement of Cylinder Head and Gasket

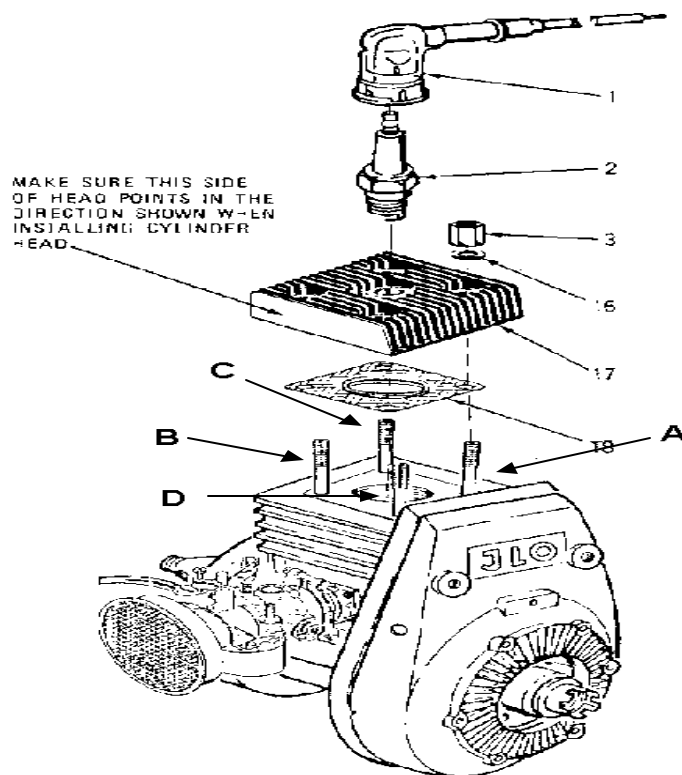


Figure 8, Replacement of Cylinder Head Gasket

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Step 9: Repair carburetor. (Figure 11)

- Disassembly.
 - a. Remove jet (8), float bowl (7), and gasket (6) from carburetor.
 - b. Holding carburetor upside down, remove hinge pin (4) from float (5).
 - c. Remove float (5) and float needle (3).
- Cleaning.
 - Wash filter and carburetor bowl in cleaning solvent. Clean all other parts with brush and solvent.
- Inspection.
 - Position float (5) so that brass hinge groove is facing up. Compare float wear pattern with illustration. (See Figure 9) If float wear is found in circled area, replace float.

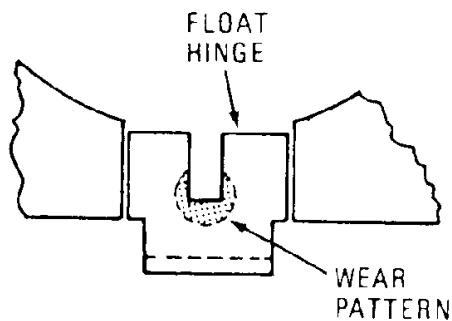


Figure 9, Float Wear Pattern

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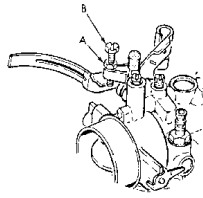


Figure 10, Float Hinge

- Inspect air filter (1) for punctures or damage to filter element.
- Inspect throttle linkage for binding, missing or damaged components.
- Inspect carburetor body for cracks, dents or missing components.

Step 10: Assembly.

- Engage float needle (3) in hinge slot of float and install float (5) on carburetor with pin (4)
- Install gasket (6), bowl (7) and jet (8).
- Install filter (1) with clamp (2).

SAFETY:

HINGE PIN (7) IS TAPERED AND CAN ONLY BE REMOVED IN OPEN DIRECTION. CARBURATOR WILL BE DAMAGED IF ATTEMPT IS MADE TO MOVE IN OPPOSITE DIRECTION.

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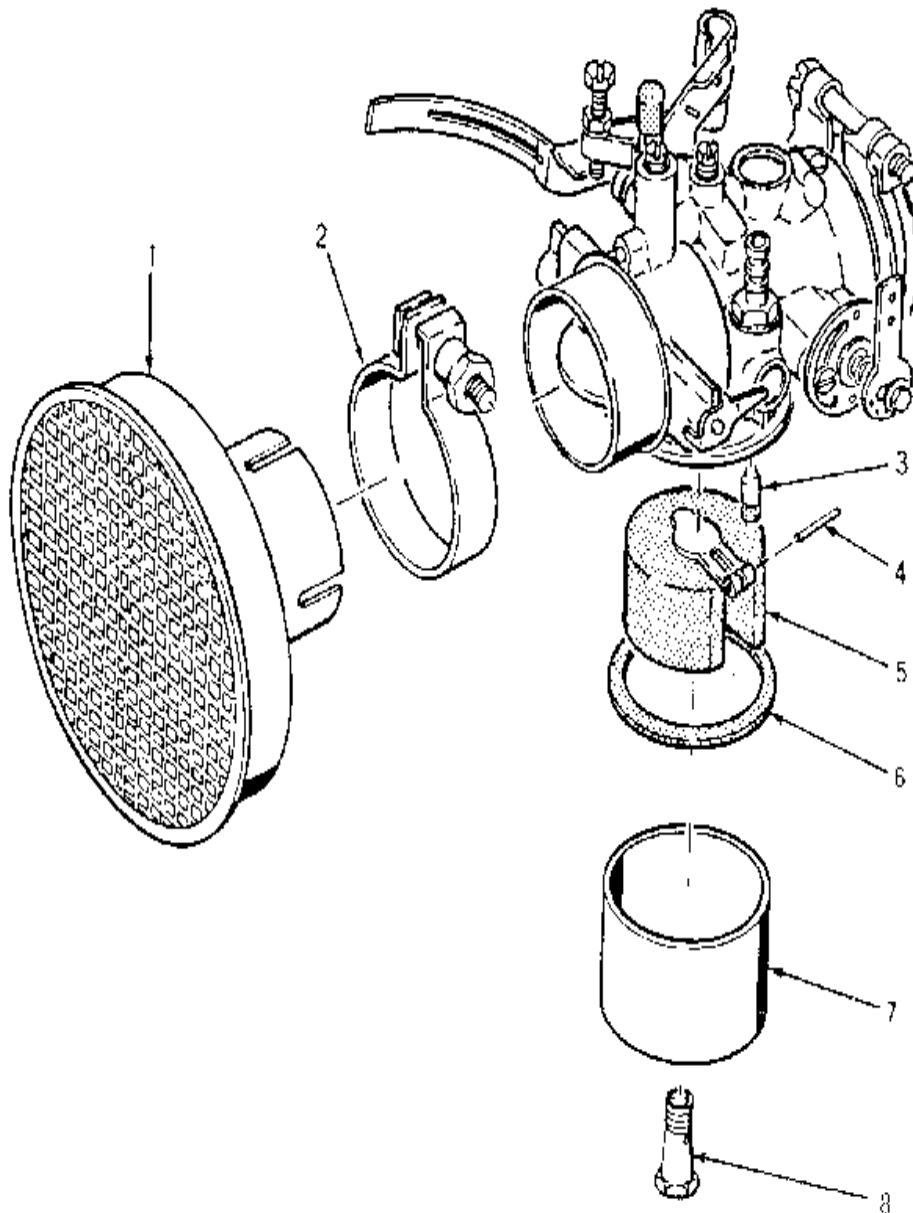


Figure 11, Carburetor

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Step 11: Repair engine speed control system. (Figure 12)

NOTE:

Repairs may be performed with engine in place or dismounted. Removal of drain plate may be necessary for accessibility.

- Remove four small bolts and two large bolts (1) and washers (2). Remove fan cover (8).
- Remove bolt (7), lockwasher (4) and nut (5).
- Note position of linkage (3) on vane (6) and remove vane from linkage.

NOTE:

Vane is purposely bent inward at the top. Do not mistake this as evidence of deformation.

- Clean all parts with cleaning solvent and inspect for cracks, elongation of linkage mounting holes and deformation of vane (6).
- Connect linkage (3) to tab of vane (6).
- Secure vane to engine block with bolt (7), nut (5) and lockwasher (4). As necessary adjust bolt (7) inward or out to make sure vane pivots freely. Do not lubricate.
- When properly adjusted, tighten nut (5) against engine block.
- Reinstall cover (8) with six bolts (1) and washers (2).

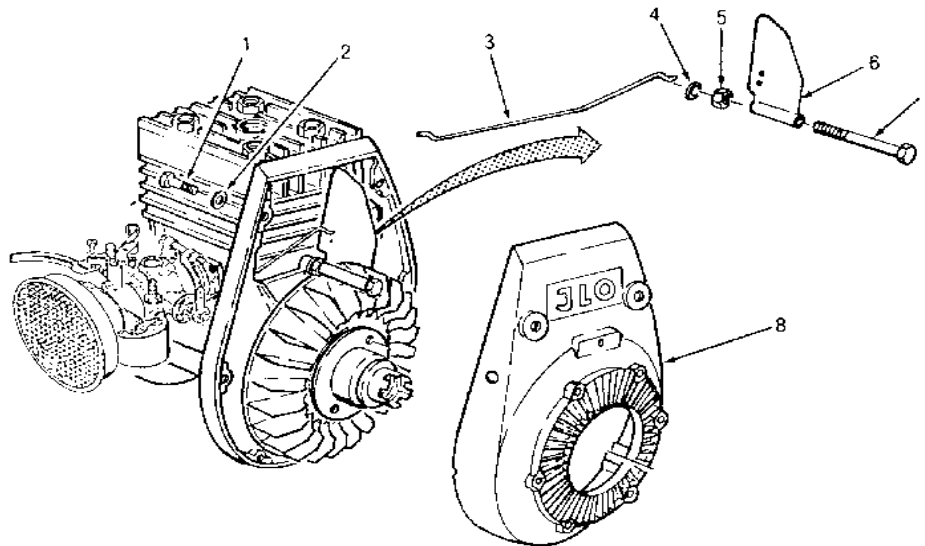


Figure 12, Repair Engine Speed Control System

Step 12: Engine compression test.

- Remove spark plug.
- Install cylinder compression tester in spark plug hole.
- Vigorously pull starter handle several times.
- Read compression gauge.
- Disassemble and repair engine if compression is less than 105 psi.

Step 13: Thawing procedures.

- If the unit has been exposed to freezing temperatures without having been operated, the unit could be frozen. Manually try to rotate the water pump pulley. If the pulley does not rotate freely, the unit is frozen. Thaw the pump/heater assembly as follows:

SAFETY:

NEVER USE A TORCH OR ANY OPEN FLAME TO THAW UNIT AS IT CAN IGNITE CAUSING PERSONNEL INJURY OR EQUIPMENT DAMAGE.

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- If the unit is not required for immediate use, proceed as follows:
- If possible, place the unit inside a shelter where the temperature is above freezing and allow thawing.
- If possible, periodically try to rotate the water pump pulley. When pulley rotates freely, unit has thawed and may be operated.
- If unit is required for immediate use, proceed as follows:
- Place unit inside a shelter where temperature is above freezing. Position unit so that heat exchanger is down and water pump inlet is pointing up.
- Pour several cups of warm, undiluted antifreeze into water pump inlet while trying to rotate water pump pulley.
- When pump rotates freely, continue pouring warm antifreeze into water pump inlet until liquid comes out water outlet.

NOTE:

If unable to heat antifreeze, let unit remain in shelter area where temperature is above freezing to thaw naturally. After thawing the unit, observe water pressure gauge for high readings.

- Thawing hoses and accessories. Hoses and accessories should be flushed with antifreeze. Water allowed to freeze in hoses and accessories could cause damage. If leaks are detected, repair. Be very alert for pressure hose damage
- Check for leaks. When unit has been started, check for leaks. Freezing could cause damage. If leaks are detected shut down and repair.

Step 14: Replacing damaged water pump pulley key.

- Key is sheared if pulley turns and pump shaft remains stationary. If key is sheared replace as follows: (Figure 13)
- Remove belts.
- Remove bolt and washer.
- Using puller, remove pulley.
- Remove damaged key, clean shaft with rags and inspect for damage. Remove burrs as necessary.

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- Position replacement key on shaft and install pulley. Secure with bolt and washer and install water pump belts.

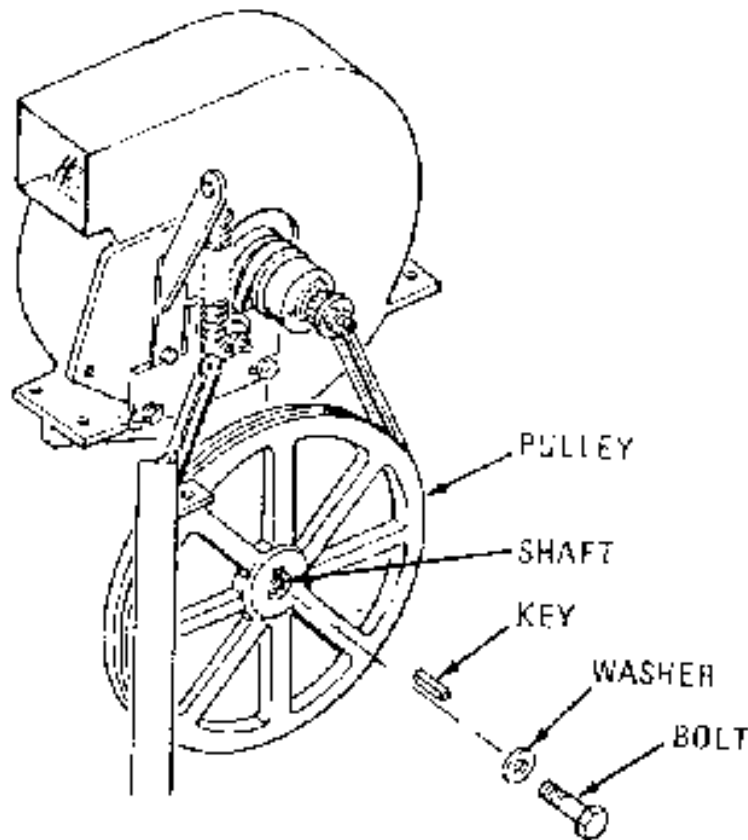


Figure 13, Replacing Damaged Water Pump Pulley Key

Step 15: Emergency shut down (burner will not extinguish).

- In the event burner will not go out when function selector switch is set to off, complete the following steps:

SAFETY:

FUEL MAY HAVE COLLECTED IN THE BURNER. ATTEMPTING TO RESTART UNIT WITH THE BURNER FULL OF FUEL CAN RESULT IN INJURY TO PERSONNEL AND DAMAGE TO EQUIPMENT. DO NOT ATTEMPT TO RESTART UNIT AFTER EMERGENCY SHUTDOWN.

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NOTE:

The burner control system is normally closed and is considered “fail-safe”. However, the one equipment malfunction (failure) that may prevent normal burner shutdown is when the burner will not go out when the function switch is set to off.

- Verify that the burner fuel valve is fully **clockwise**.
- Verify the function selector switch is set to **OFF**.

HINT:

The heater fuel can lid assembly uses two size fuel hoses. The smaller hose is the heater fuel return line. The larger hose is the heater fuel suction line. In the following procedure, make sure you kink the large fuel hose on top of the heater fuel can lid.

- Bend larger hose connected to heater fuel can lid until hose kinks (no fuel will pass through hose). Hold hose firmly. **DO NOT RELEASE HOSE**.

HINT:

If operating in WANDS mode, squeeze spray wand triggers to ensure water flow.

- Listen for burner to go out (rumbling noise will stop). Continue to hold (kink) hose until WATER TEMPERATURE gauge indicates 40 deg. C (74 deg. F) or less.
- Lift throttle to reduce engine speed to idle. Use EMERGENCY STOP switch to stop engine.
- Release fuel hose.
- **DO NOT ATTEMPT TO RESTART UNIT UNTIL YOU FIND THE PROBLEM.**

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Step 16: Repair clutch assembly. (Figure 14)

- Removal and Disassembly.
- Remove four nuts (1), washers (2), and bolts (4).
- Using hard rubber mallet, tap edges of housing (3) to loosen seal. Once seal is broken, twist clutch housing (3) back and forth and remove from engine.
- Remove four small bolts and two large bolts (8), washers (9) and cover (10) then remove three nuts (11), washers (16), carrier (12) and gasket (15).
- Install crankshaft-retaining tool on the three exposed screws on fan to keep shaft from turning. Secure with three nuts (11).
- Remove nut (14) and lockwasher (5).
- Using clutch puller, remove clutch (6) from crankshaft (7).
- Remove key (13).

Step 17: Cleaning.

- Remove dust and other particles from housing and disk with a brush. Do not use cleaning solvent.
- Remove locking compound from mating surfaces.

Step 18: Inspection.

- Inspect clutch disk (6) for wear, loose segments or other physical damage. Replace if segments are loose, wear is uneven or pads are worn flush with side cover plates.
- Inspect clutch housing (3) for worn/seized bearings. (Clutch will be noisy or bind when shaft is turned.) Replace housing if defective.
- Inspect inner drum for cracks, scoring, and chipping. Replace clutch housing if drum is defective.
- Inspect mounting hardware for rust and corrosion and stripped threads. Replace as necessary.

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Step 19: Assembly and Installation.

- Install key (13) and clutch disk (6) on crankshaft (7).
- Install lockwasher (5) and nut (14). Torque nut (14) to 32.5-ft. lbs.
- Remove crankshaft retaining tool and reinstall gasket (15), and carrier (12), with three nuts (11) and washers (16).
- Apply a bead of locking compound to housing (3) mating surfaces.
- Install housing (3) with four bolts (4), washers (2) and nuts (1).
- Install fan cover (10) and secure with bolts (8) and washers (9).
- Install centrifugal fan.

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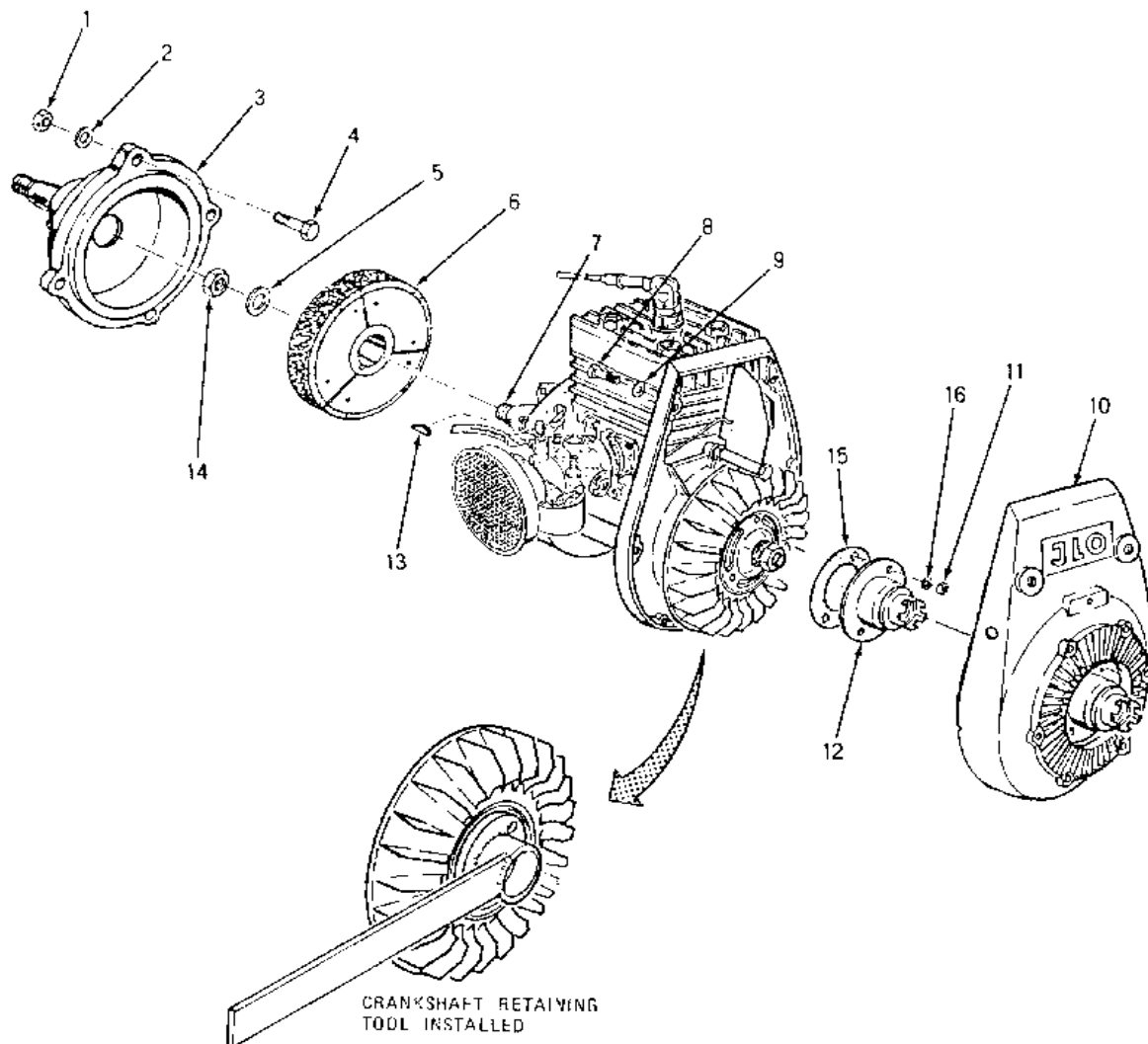


Figure 14, Repair Clutch Assembly

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Step 20: Repair mica window. (Figure 15)

SAFETY:

THE MICA WINDOW IS FRAGILE. USE CARE WHEN HANDLING IT TO PREVENT DAMAGE.

- Shut down unit.
- Using 10-mm wrench, remove two bolts (14), lock washers (13), and flat washers (12) from photocell and tee assembly (11).
- Carefully separate photocell and tee assembly (11), mica window (10), and plate (9) from heat exchanger (8).
- Clean soot from mica window (10) using cheesecloth.
- Inspect mica window for cracks through center of mica sheet. If mica window is cracked through center or cannot be cleaned replace.
- Position plate (9), mica window (10), and photocell and tee assembly (11), on heat exchanger (8). Install two flat washers (12), lock washers (13), and bolts.

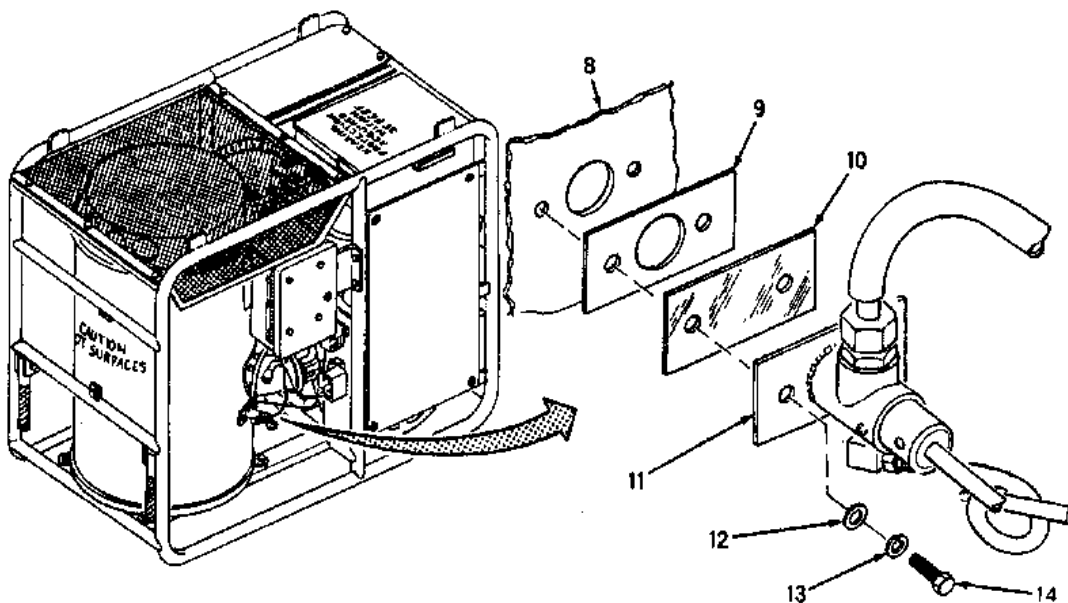


Figure 15, Repair Mica Window

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Step 21: Repairing fuel pump.

- Repairing fuel pump consists of replacement of elbows, nipples and tee. If pump is defective, replace entire assembly.

Step 22: Replace heater fuel filter. (Figure 16)

1. Disassembly:

- Loosen thumbscrew (15) and drain fuel from sediment bowl, being sure to catch fuel in any available container. Remove thumbscrew and gasket (16) when all fuel is drained.
- Unscrew bolt (3) while keeping light upward pressure on filter bottom (14), then remove bottom (14), bowl (12), and filter element (10) as a unit and separate.
- Remove gasket (13) from base, gasket (11) from bowl (12) and gaskets (8 and 9) from filter head (17).
- Remove two nuts (1), bolts (7) and washers (2 and 6).
- Remove bolt (3), washer (4), gasket (5) and filter head (17).
- Clean all parts with cleaning solvent and inspect for serviceability. Discard unserviceable parts and all gaskets for which replacement is provided with filter element kit.

2. Assembly:

- Position bolt (3), washer (4) and gasket (5) on filter head (17) and secure head to frame with bolts (7), washer (2 and 6) and nut (1).

NOTE:

Gasket (9) provided in filter element kit is identified with a blue mark on outer rim and is larger than gasket (11), which is also part of the kit. Be sure not to interchange.

- Install gaskets (8 and 9) on filter head (17).
- Install gasket (13) on filter bottom (14).
- Install gasket (11) on bowl (12)
- Position filter element (10), bowl (12) and filter bottom (14) on filter head (17).

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- Turn filter assembly so that thumbscrew will be positioned outward carefully aligns all components and tighten bolt (3), making sure gaskets remain in place.
- Install gasket (16) and thumbscrew (15).

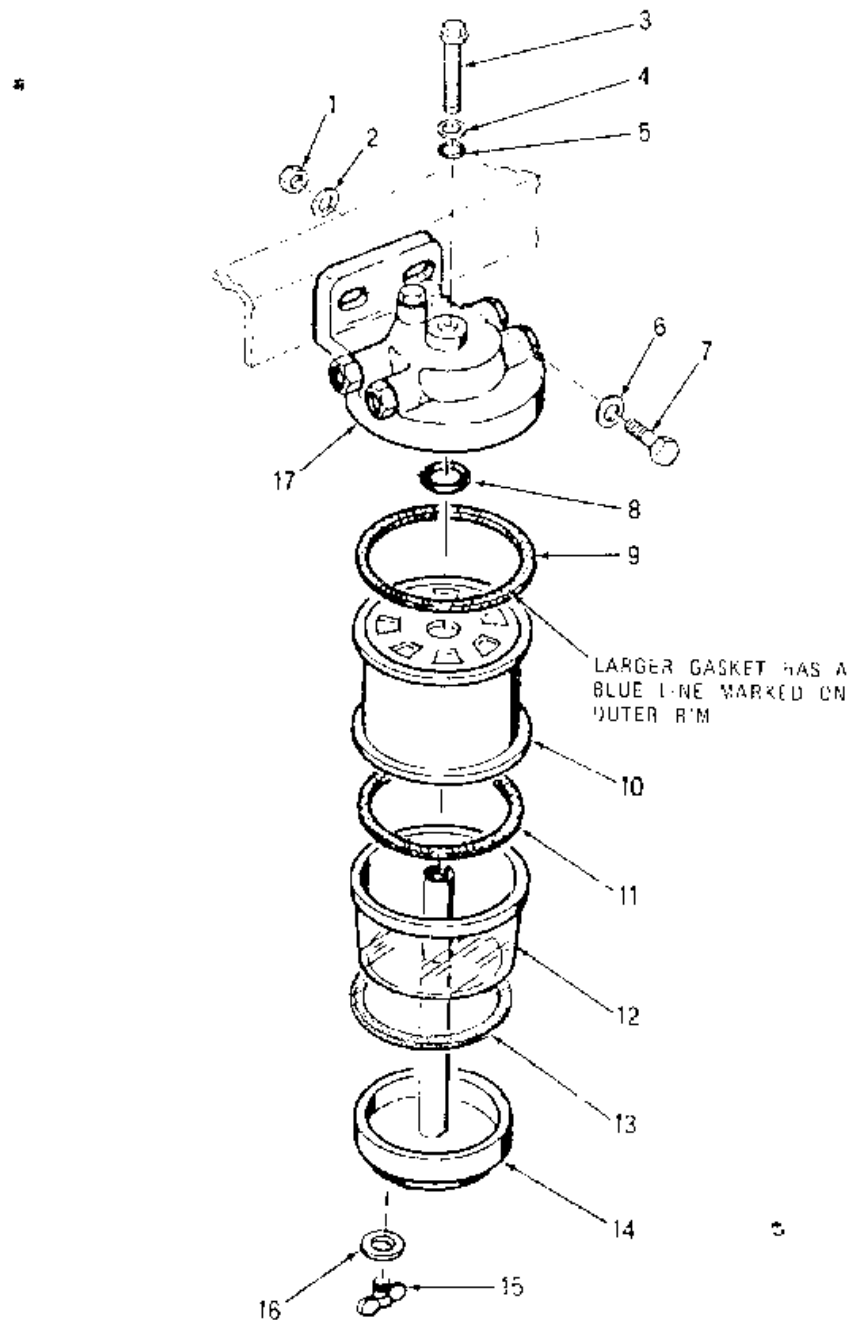


Figure 16, Fuel Filter

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Step 23: Photocell. (Figure 17)

1. Removal and Disassembly:

- Disconnect photocell assembly wires (33 and 34) from junction box (TB2-5 and TB2-6) and pull wires out of junction box.
- Loosen setscrew (9) and remove photocell assembly (4) from tee (3).

2. Assembly and Installation:

- Do **not** clean Photocell with any cleaning solvent.
- Inspect for serviceability.
- Wipe photocell assembly with rags, making sure photo element (eye) is clean.
- Install photocell assembly (4) on Tee (3) with screw (9), being careful not to crack photocell, and connect wire 33 to TB2-5 and wire 34 to TB2-6.

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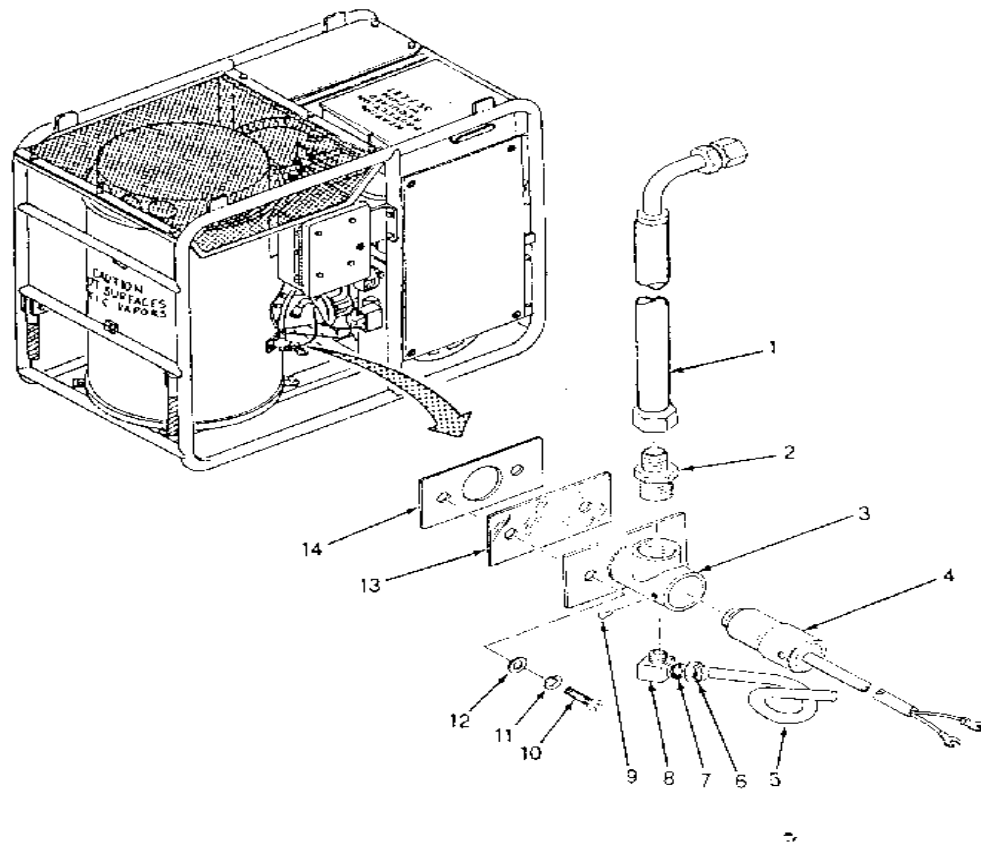


Figure 17, Photocell

Review Questions For Repairs

| Question | Answer |
|--|---------------------|
| 1. To UN-Vapor lock the engine fuel system you would move the LDU to a cool shaded area, cooling down the fuel tank with wet rags. | a. True b. False |
| 2. Use a feeler gauge to check the gap clearance on a spark plug ranging from 0.10 – 0.25 in. | a. True b. False |
| 3. An adequate spark on a spark plug will be yellowish in color. | a. True b. False |

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| | |
|--|---------------------|
| 4. When checking continuity between primary winding terminal and ground, the resistance should be significantly above 0.5 ohms. | a. True b. False |
| 5. The continuity on a power-generating coil should be approximately 0.5 ohms. | a. True b. False |
| 6. After checking the points on the ignition system it is important to properly position the fan. Failure to do this will result in inability to start the engine. | a. True b. False |
| 7. When checking the ignition points the first step after all necessary components are disassembled is to turn the engine shaft until piston is at BTDC. | a. True b. False |
| 8. When adjusting the engine timing, TDC is reached when the dial indicator reverses in direction. | a. True b. False |

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**Review Questions
For
Repairs**

| | |
|--|---------------------|
| 9. It is important to inscribe a mark on the cylinder head to note which side is facing the carburetor prior to removing it. | a. True b. False |
| 10. The cylinder head torque is 10 – 12 ft. lbs. | a. True b. False |
| 11. Clean all carburetor parts with a brush and cleaning solvent. | a. True b. False |
| 12. The vane on the engine speed control system is purposely bent inward at the top. | a. True b. False |
| 13. An engine repair is needed if compression is less than 105 PSI. | a. True b. False |
| 14. One way to thaw the water system if frozen is by using an open flame. | a. True b. False |
| 15. The burner control system is normally closed considering it “fail safe”. | a. True b. False |
| 16. Remove any soot build up on the Mica window with a rag and cleaning solvent. | a. True b. False |
| 17. All three gaskets on the Heater Fuel system are interchangeable. | a. True b. False |
| 18. You must not clean the photocell eye with a cleaning solvent. | a. True b. False |

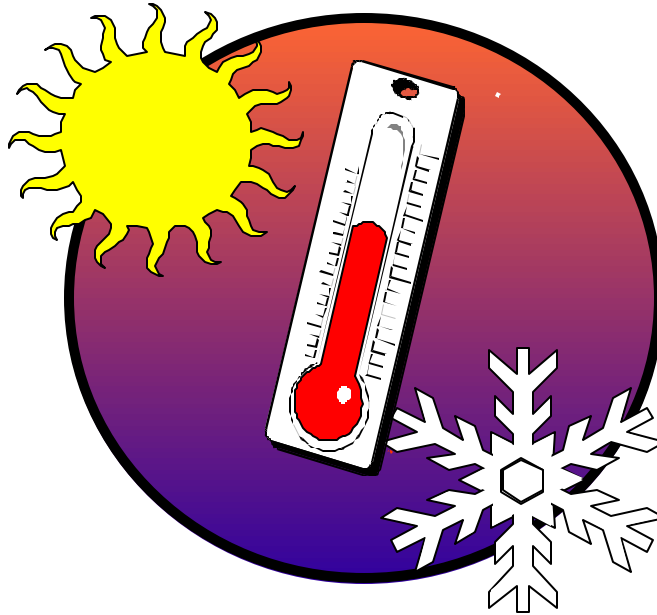
Notice. This AFQTP is NOT intended to replace the applicable technical references nor is it intended to replace hands-on training. It is to be used in conjunction with these for training purposes only.

REPAIRS

| Performance Checklist | | |
|---|-----|----|
| Step | Yes | No |
| 1. Drain a contaminated Engine fuel system | | |
| 2. UN-vapor lock the engine fuel system | | |
| 3. Adjust spark plug | | |
| 4. Check adequacy of spark on spark plug | | |
| 5. Check ignition system <ul style="list-style-type: none"> • Ignition coil • Condenser • Power generating coil • Ignition points • Timing | | |
| 6. Replace cylinder head | | |
| 7. Repair carburetor | | |
| 8. Repair engine speed control system | | |
| 9. Perform engine compression test | | |
| 10. Thaw the pump/heater assembly | | |
| 11. Replace water pump pulley key | | |
| 12. Perform Emergency shut down | | |
| 13. Repair clutch assembly | | |
| 14. Repair Mica window | | |
| 15. Repair fuel pump | | |
| 16. Replace heater fuel filter | | |
| 17. Replace photocell | | |

FEEDBACK: Trainer should provide both positive and/or negative feedback to the trainee immediately after the task is performed. This will ensure the issue is still fresh in the mind of both the trainee and trainer.

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FIELD BOILERS (M-80)

MODULE 27

AFQTP UNIT 3

SET-UP

(27.3.2.2.)

Notice. This AFQTP is NOT intended to replace the applicable technical references nor is it intended to replace hands-on training. It is to be used in conjunction with these for training purposes only.

SET-UP***Task Training Guide***

| | |
|--|--|
| STS Reference Number/Title: | 27.3.2.2. Set-up |
| Training References: | <ul style="list-style-type: none"> • CD-ROM 3E1X1-27.3.2c Ver. 1.0 M-80 Field Boiler QTP |
| Prerequisites: | <ul style="list-style-type: none"> • Possess as a minimum a, 3E131 AFSC. |
| Equipment/Tools Required: | <ul style="list-style-type: none"> • Personnel Protective Equipment • Standard HVAC/R Tool bag |
| Learning Objective: | <ul style="list-style-type: none"> • Trainee should know the steps to set-up a M-80 Field Boiler. |
| Samples of Behavior: | <ul style="list-style-type: none"> • Trainee should be able to identify the required items to be attached and should be able to safely setup a M-80 Field Boiler. |
| Notes: | |
| <ul style="list-style-type: none"> • The tasks are covered in the computer-based QTP, “<u>Field Boilers (M-80)</u>” 27.3.2.C • Any safety violation is an automatic failure. | |

To perform this task, view AFQTP 3E1X1-27.3.2C Version 1.0 M-80 Field Boiler CD-ROM.

NOTE:

In the CD-ROM there are tests after each section. Complete each section and answer the questions.

CerTest numbers 8055, 8056, 8057, 8058, and 8059 are mandatory for this task.

HINT: To increase the chances of obtaining a passing score, recommend you take each corresponding CerTest after you complete a section. Contact your UETM to schedule testing.

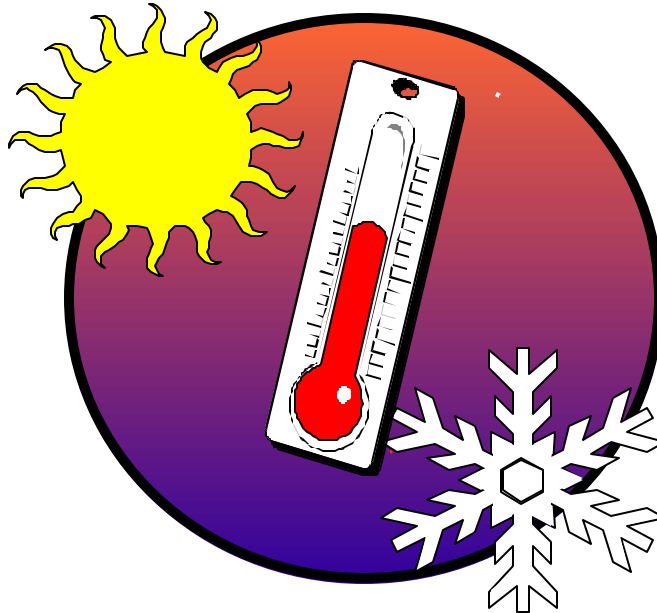
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PERFORM SET-UP

| Performance Checklist | | |
|---|-----|----|
| Step | Yes | No |
| 1. Did the trainee perform proper set-up? | | |

FEEDBACK: Trainer should provide both positive and/or negative feedback to the trainee immediately after the task is performed. This will ensure the issue is still fresh in the mind of both the trainee and trainer.

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FIELD BOILERS (M-80)

MODULE 27

AFQTP UNIT 3

PERFORM OPERATIONAL TESTS

(27.3.2.3.)

Notice. This AFQTP is NOT intended to replace the applicable technical references nor is it intended to replace hands-on training. It is to be used in conjunction with these for training purposes only.

PERFORM OPERATIONAL TESTS***Task Training Guide***

| | |
|--|--|
| STS Reference Number/Title: | 27.3.2.3. Perform Operational Tests |
| Training References: | <ul style="list-style-type: none"> • CD-ROM 3E1X1-27.3.2C Ver. 1.0 M-80 Field Boiler QTP |
| Prerequisites: | <ul style="list-style-type: none"> • Possess as a minimum a, 3E131 AFSC. |
| Equipment/Tools Required: | <ul style="list-style-type: none"> • Personnel Protective Equipment • Standard HVAC/R Tool bag |
| Learning Objective: | <ul style="list-style-type: none"> • Trainee should know the required steps to perform an operational test of a M-80 Field Boiler. |
| Samples of Behavior: | <ul style="list-style-type: none"> • Trainee should be able to identify the required steps to be performed and should be able to safely complete a per-operational test of a M-80 Field Boiler. |
| Notes: | |
| <ul style="list-style-type: none"> • The tasks are covered in the computer-based QTP, “Field Boilers (M-80)” 27.3.2. • Any safety violation is an automatic failure. | |

To perform this task, view AFQTP 3E1X1-27.3.2C Version 1.0 M-80 Field Boiler CD-ROM.

NOTE:

In the CD-ROM there are tests after each section. Complete each section and answer the questions.

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PERFORM OPERATIONAL TEST

| Performance Checklist | | |
|--|-----|----|
| Step | Yes | No |
| 1. Did the trainee perform proper operational tests? | | |

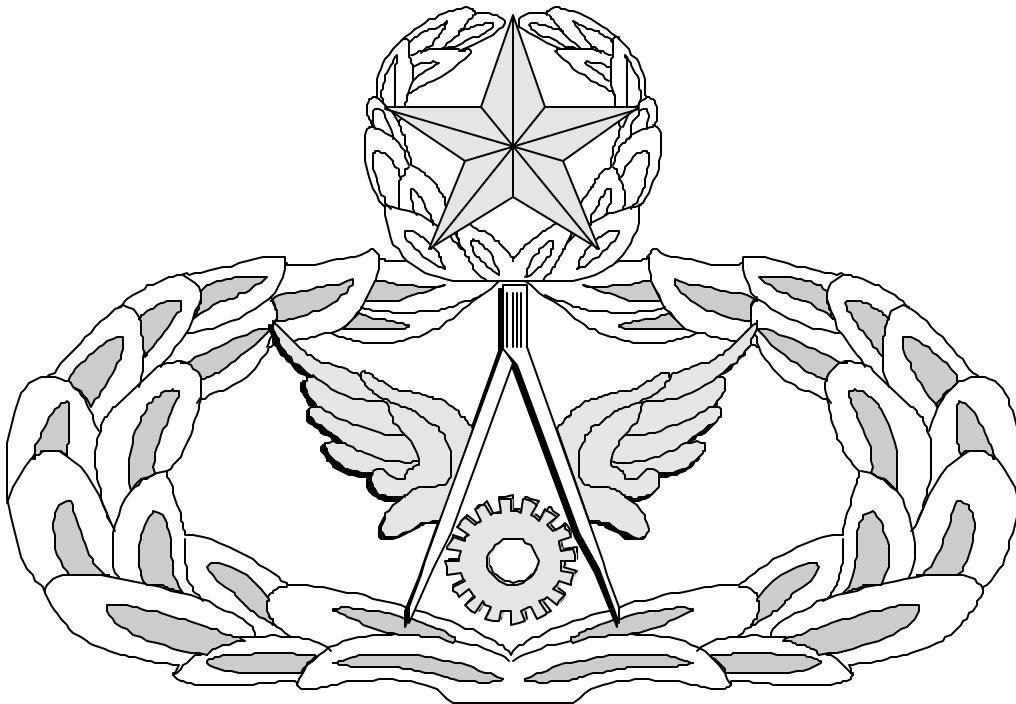
FEEDBACK: Trainer should provide both positive and/or negative feedback to the trainee immediately after the task is performed. This will ensure the issue is still fresh in the mind of both the trainee and trainer.

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Air Force Civil Engineer

QUALIFICATION TRAINING PACKAGE (QTP)

REVIEW ANSWER KEY



For
HVAC/Refrigeration

(3E1X1)

MODULE 27

AFSC SPECIFIC CONTINGENCY RESPONSIBILITIES

Notice. This AFQTP is NOT intended to replace the applicable technical references nor is it intended to replace hands-on training. It is to be used in conjunction with these for training purposes only.

Key-1

SETUP TENT HEATER MODEL 1941, TYPE I
(3E1X1-27.2.1.3.2.)

| Question | Answer |
|--|--|
| 1. If you are setting up a tent heater in a tent that has wooden floors, what must be done before you place the heater on the floor? | a. Place heater base in sandbox |
| 2. What is the purpose of the heater base on an assembled stove? | b. As an ashpit which provides a draft for the fire and enables the adjustment of heat output by regulating the amount of air entering the unit. |
| 3. What part of the tent heater is used as a support for the fuel bed? | c. Grate |
| 4. What is the purpose of the spark arrestor? | d. To prevent sparks from the fire to be drawn out of the tent heater and possibly starting a fire. |
| 5. State the purpose of the heater top. | Allows easy access to add fuel, fits the opening on the heater top. |

SETUP TENT HEATER MODEL 1941, TYPE II
(3E1X1-27.2.1.3.2.)

| Question | Answer |
|--|--|
| 1. What components are located in the heater base? | d. All the above |
| 2. Where is the flame spreader installed? | a. Heater base |
| 3. What is the minimum height the fuel can should be installed above the float valve? | b. 2 feet |
| 4. What is used to provide a means of coupling the fuel hose to the fuel supply on a 5-gallon can? | a. Gravity feed adapter with drip interceptor. |
| 5. The drip interceptor consists of a short rubber | a. True |

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| | |
|---------------------------------------|--|
| hose held in a loop by a metal plate? | |
|---------------------------------------|--|

TENT HEATER OPERATIONAL TESTS
MODEL 1941, TYPE I
(3E1X1-27.2.1.3.3)

| Question | Answer |
|---|---------------------|
| 1. What is the position of the flue damper when you begin the operational test? | a. Open position |
| 2. How is the heat output regulated? | b. All of the above |
| 3. When operating the type I tent heater, how high should you add coal on the grate? | c. 3 inches |
| 4. You remove ashes and clinkers from the grate assembly by pushing the draw gate gently back and forth with shaker until a faint red glow appears. | d. True |

TENT HEATER OPERATIONAL TESTS
MODEL 1941, TYPE II
(3E1X1-27.2.1.3.3.)

| Question | Answer |
|--|--|
| 1. How long will 5 gallons of fuel last at maximum heat output? | a. Nearly 8 hours |
| 2. Name the parts that make up the heater base. | b. All the above |
| 3. What is used to connect the float valve to the reducer of the heater base? | c. ¾ inch nipple |
| 4. What is the first step in starting the type II tent heater? | The first step in starting the tent heater is to remove the heater lid. |
| 5. What does the float valve of the oil burner provide? | The float valve provides a graduated supply and uniform flow of the fuel to the burner. |
| 6. During startup, what is the position of the ON-OFF valve knob and the flow adjustment knob? | The ON-OFF valve knob is in the ON position and the flow adjustment knob is set at 9 during initial startup. |

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| | |
|--|--|
| 7. How much time should pass before you set the adjustment knob to the size flame desired. | You must allow 15 minutes to pass before you move the adjustment knob to get the desired flame size. |
| 8. If the flame is accidentally extinguished, what should you do? | You should immediately turn the ON-OFF knob to the OFF position. Allow the burner to cool, then wipe excess fuel from the burner bottom before re-lighting. NEVER attempt to re-light a heater while it is still warm. |

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**PERFORM OPERATIONAL TEST
(3E1X1-27.3.1.1.)**

| Question | Answer |
|--|---|
| 1. What is the purpose of the M-17 LDU? | The M-17 LDU purpose is to decontaminate equipment, material and personnel of any nuclear, biological or chemical agents that may be used against U.S. and /or Allied military sites. |
| 2. What are the three modes of operation? | Spray wand, Injector Connection, and Shower. |
| 3. When using the M-17 LDU, when does the burner ignite? | The burner automatically ignites when water is flowing and the function selector switch is set to either the shower or wands position. |
| 4. What type of fuel does the engine use? | The fuel used in the engine will be a mixture of one quart of two-cycle oil to five gallons of leaded or unleaded gasoline. |
| 5. What are the maximum and minimum temperature settings for the various modes of operation? | Wands/injector mode will be 250F max., with the unit ignition start up at 212F min.. Shower mode will be 113F max., with the unit ignition start up at 90F min.. |

**SERVICE/PERIODIC MAINTENANCE
(3E1X1-27.3.1.2.)**

| Question | Answer |
|--|--|
| 1. When inspecting the hardware of the M-17 LDU, what is the most important item to check? | Ensure the engine mounting bolts remain loose. |
| 2. What is the warning concerning the high voltage tripler? | To prevent electrical shock! Do not clean the high voltage tripler while engine is running, engine must be shut down. |
| 3. When should you inspect the filter in the fuel system of the engine assembly? | You should inspect before, during, and after the operation of the M-17 LDU. |
| 4. What is done to the pulley on the water inlet? | The pulley must be turn by hand to verify free rotation. |
| 5. How much scale is allowed in the water outlet before notifying your supervisor? | 1/16 of an inch. |

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TROUBLESHOOT
(3E1X1-27.3.1.3.)

| Question | Answer |
|---|-----------------------------|
| 1. What position must the throttle be in prior to starting the engine? | b. 1/3 MAX |
| 2. What must be done to the carburetor on the first start of the day or a cold engine? | a. Prime the carburetor |
| 3. Bubbles or a separate layer of liquid below the fuel will indicate water in a fuel filter? | a. True |
| 4. What outside air temperature can contribute to a fuel system vapor lock? | c. 80 deg F |
| 5. Of the following problems, which is not contributed by a fouled spark plug? | d. Low engine speed |
| 6. What is the minimum compression of an engine before it needs repairing? | c. 105 psi |
| 7. What position should the engine throttle be set at when in normal operation? | d. Full position |
| 8. Other than a loose or broken belt on the water pump, what would also cause low or no water pressure? | d. All of the above. |
| 9. Timing out of adjustment will cause the engine to overheat? | a. True |
| 10. A shorted condenser in your points will cause what problem? | b. Fail to operate |
| 11. If temperature is above 130deg. C and pressure is above 230 PSI, which component should you replace? | b. High Temperature Cut Out |
| 12. If your burner fails to shut down and you manually close the fuel valve assembly, where is your problem? | d. Fuel Control valve |
| 13. What is your minimum water pressure before the burner will not ignite? | a. 40 PSI |
| 14. What is considered as an alternative fuel source? | e. Both B & C |
| 15. If the water supply temperature is above 32deg C (90deg F), what position of the function switch will the burner not light? | a. Showers |
| 16. At what temperature should you replace diesel with MOGAS? | a. 60 deg. F |
| 17. What should you look for when you inspect the mica window? | c. Both A & B |

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| | |
|--|---------------------|
| 18. What is the minimum voltage measured on an igniter assembly before you replace it? | b. Negative 6.5 VDC |
|--|---------------------|

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| | |
|---|--------------------------|
| 19. What must you replace when you read 25 VDC, when checking your high-pressure cutout (HPCO) switch between TB3-8 with ground at TB3-1, with the system operating in wands and wands connected. | d. Manometer assembly |
| 20. What must you replace when checking the electrical output from the engine power-generating coil and you read 5 VAC with the engine throttle at max? | a. Power-generating coil |

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REPAIRS
(3E1X1-27.3.1.4.)

| Question | Answer |
|--|----------|
| 1. To UN-Vapor lock the engine fuel system you would move the LDU to a cool shaded area, cooling down the fuel tank with wet rags. | a. True |
| 2. Use a feeler gauge to check the gap clearance on a spark plug ranging from 0.10 – 0.25 in. | b. False |
| 3. An adequate spark on a spark plug will be yellowish in color. | b. False |
| 4. When checking continuity between primary winding terminal and ground, the resistance should be significantly above 0.5 ohms. | b. False |
| 5. The continuity on a power-generating coil should be approximately 0.5 ohms. | a. True |
| 6. After checking the points on the ignition system it is important to properly position the fan. Failure to do this will result in inability to start the engine. | a. True |
| 7. When checking the ignition points the first step after all necessary components are disassembled is to turn the engine shaft until piston is at BTDC. | b. False |
| 8. When adjusting the engine timing, TDC is reached when the dial indicator reverses in direction. | a. True |
| 9. It is important to inscribe a mark on the cylinder head to note which side is facing the carburetor prior to removing it. | a. True |
| 10. The cylinder head torque is 10 – 12 ft. lbs. | b. False |
| 11. Clean all carburetor parts with a brush and cleaning solvent. | b. False |
| 12. The vane on the engine speed control system is purposely bent inward at the top. | a. True |
| 13. An engine repair is needed if compression is less than 105 PSI. | a. True |
| 14. One way to thaw the water system if frozen is by using an open flame. | b. False |
| 15. The burner control system is normally closed considering it “fail safe”. | a. True |

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